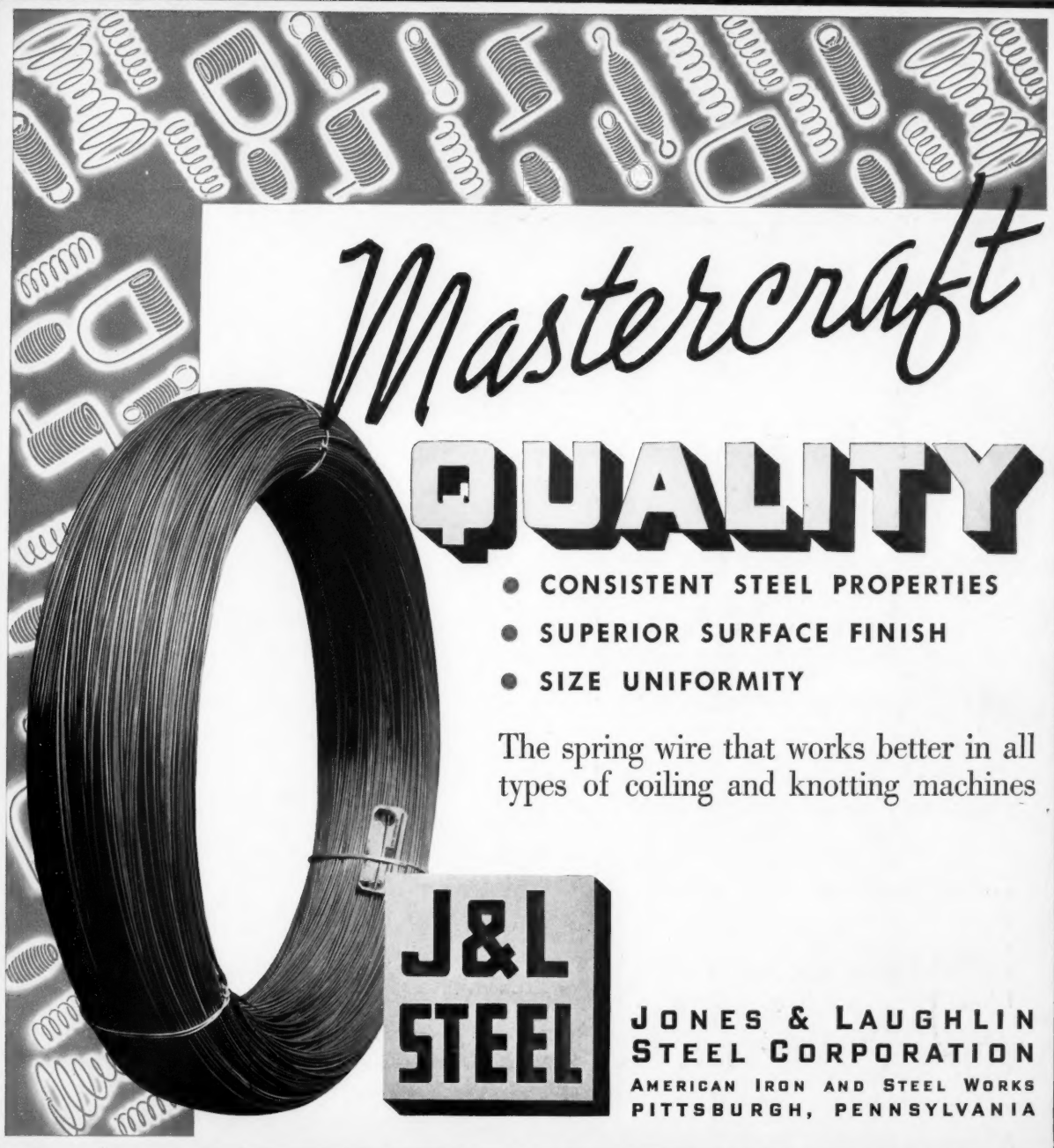
WIRE AND WIRE PRODUCTS

APRIL 1941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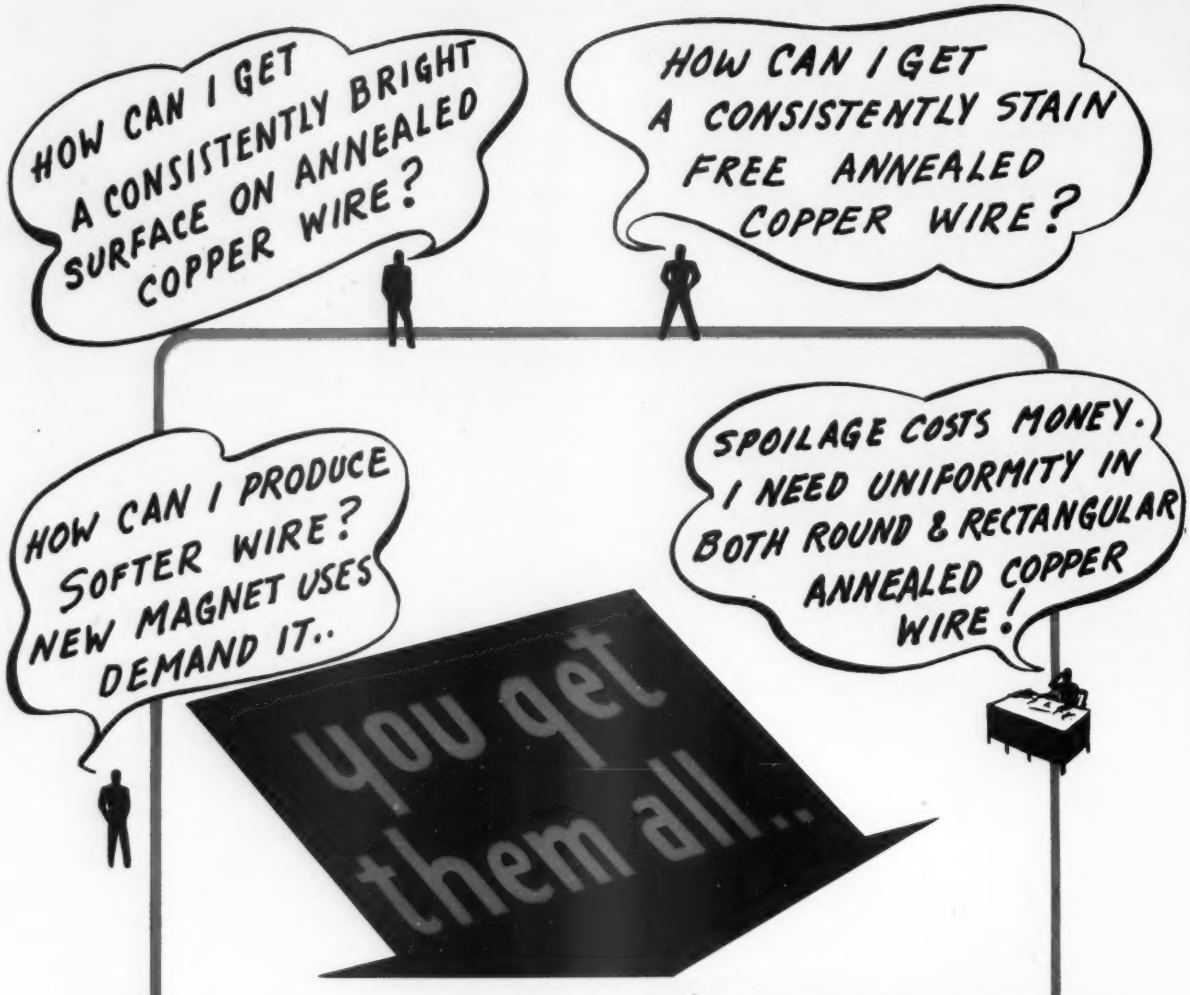
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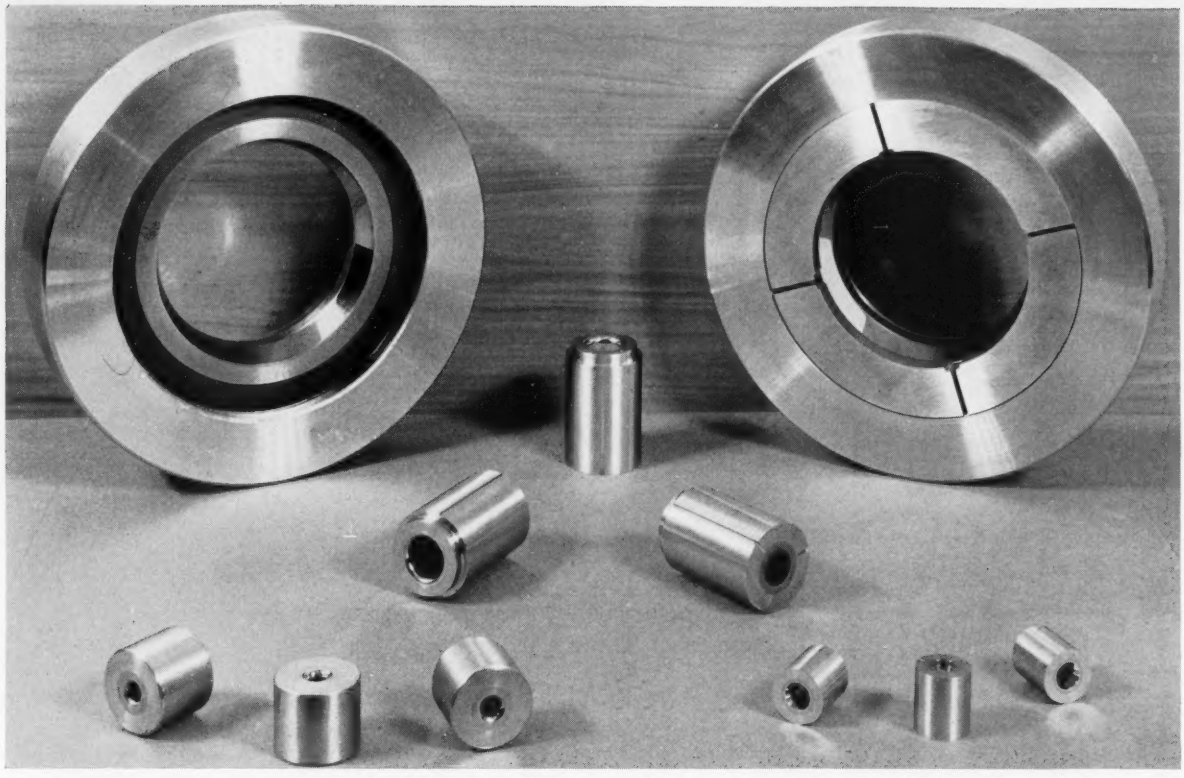

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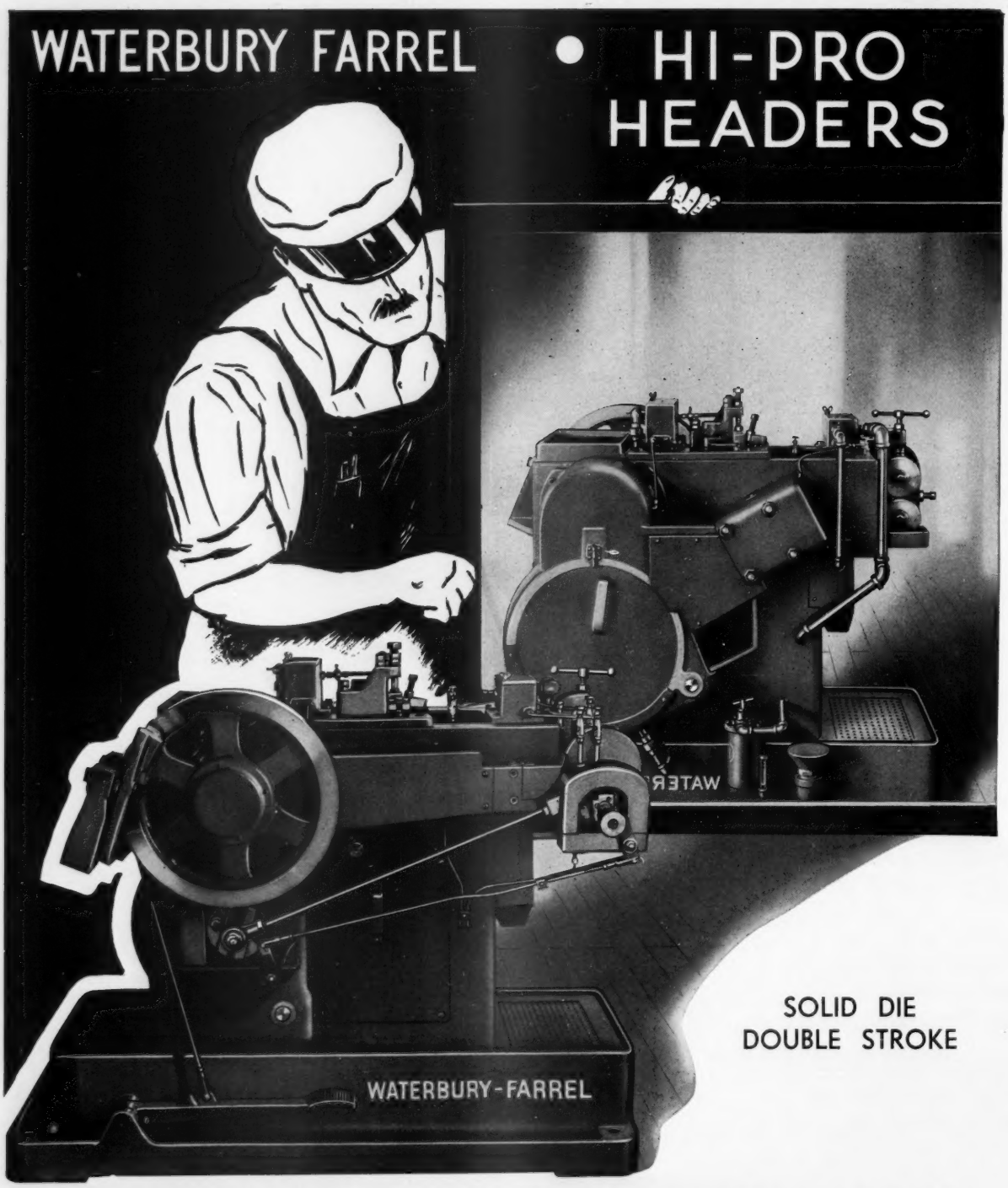

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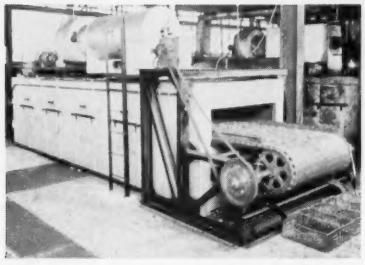

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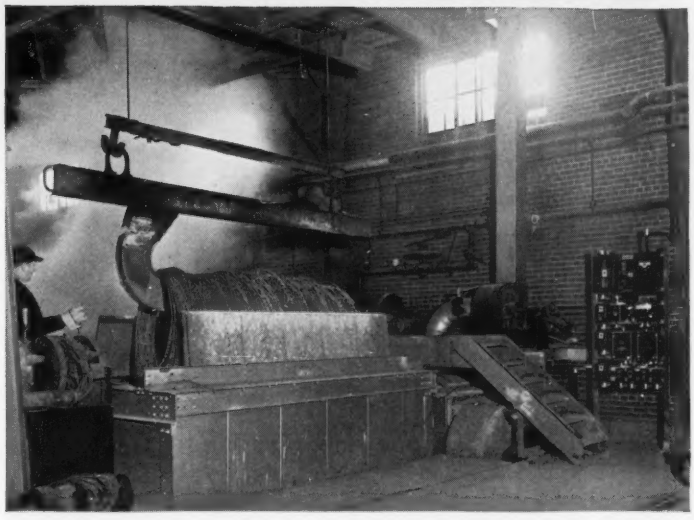

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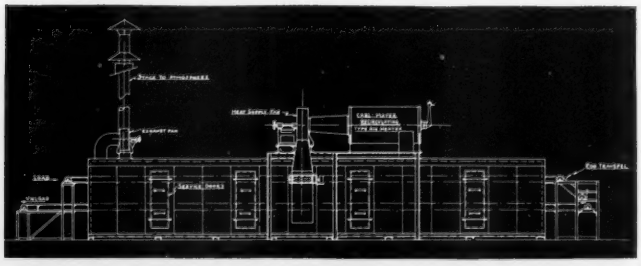

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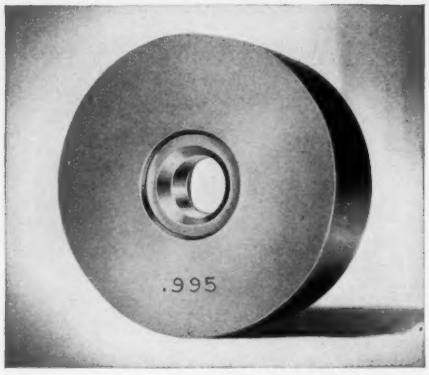

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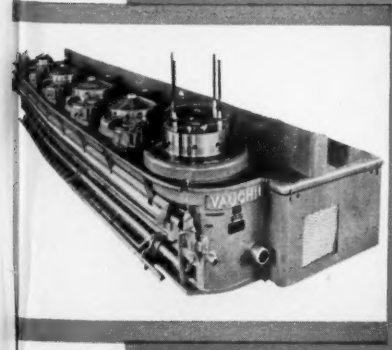

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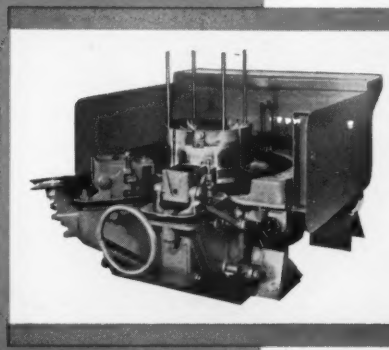

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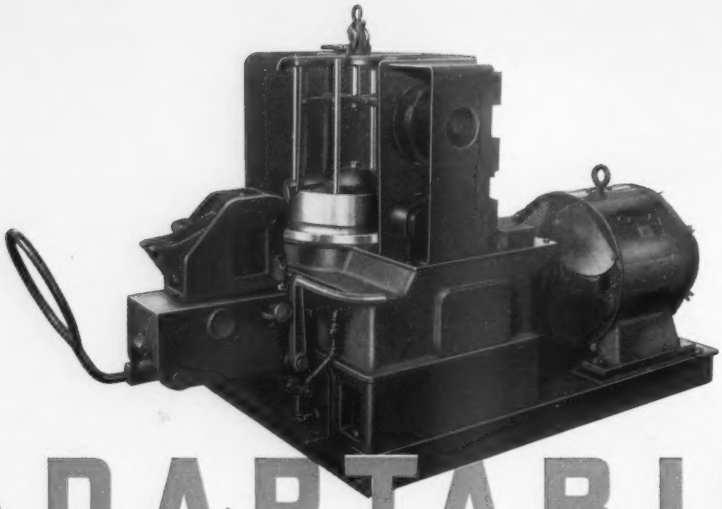

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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING—ROLLING—EXTRUDING—FORMING—FABRICATING

Vol. 16 APRIL, 1941 No. 4

Designated as

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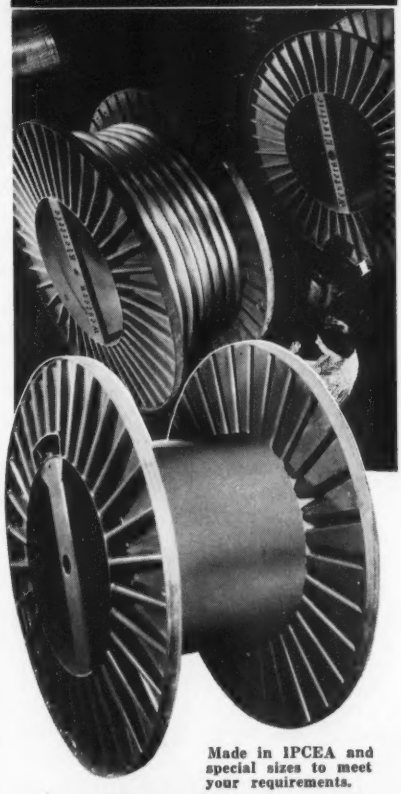

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DRAWING --- ROLLING --- EXTRUDING --- FORMING --- FABRICATING

Vol. 16 APRIL, 1941 No. 4

Wire-Making Experiments With Sintered Copper

PART I

By Claus G. Goetzel, Ph.D.,
Assistant Director of Research,
American Electro Metal Corp., Yonkers, N. Y.

ONE of the most modern and interesting branches of today's metallurgical engineering is the rapidly growing field of powder metallurgy. Solid metallic parts in the form of shaped pieces or of sheets, slabs, strips or wires are produced by a series of more or less complicated manipulations from finely comminuted metals. During the manufacture of such parts, the metallic powders are subjected after careful preparation to a molding and a heat treating operation, as is known in the field of ceramics or plastics.

✦ ✦ ✦

THE molding of the powders is generally carried out at high pressures in specially designed dies and is known as compacting or briquetting. Such pressing of metallic powder particles into a coherent mass is usually carried out at room temperature but can also be accomplished successfully at elevated temperatures, thus partly or fully replacing the subsequent sintering or "firing" treatment of the briquettes.

CLAUS GUENTER GOETZEL

Born in Berlin, Germany, 1913. From April, 1931 to December, 1935, studied mechanical engineering at the "Technische Hochschule," Berlin-Charlottenburg, Germany. In advanced studies engaged in research and in a special training in metallurgy and testing of materials at the "Technische Hochschule" and the "Staatliche Materialpruefungsamt," Berlin, Germany. Graduated December, 1935, and received the German engineering degree "Diplom-Ingenieur". In the United States he completed his metallurgical plant and research experience and became connected with the Hardy Metallurgical Company in December, 1936, as metallurgist, in charge of the research laboratory for development work in the field of powder metallurgy. In September, 1937, he entered the School of Mines, Columbia University, as a graduate student and obtained the degree of Ph.D. in 1939. He then entered the laboratory staff of the American Electro Metal Corporation, Yonkers, New York, in the capacity of Assistant Director of Research.

THE purpose of the heat treatment is to consolidate the agglomerate of a multitude of microscopic metal particles into one coherent unit. During sintering at elevated temperatures an increased movement of the atoms within the powder particles results in changes of the microstructure of the compact. Consequently, such phenomena as coalescense and diffusion are replacing the initial adhesion forces which are possibly aided by superficial friction and "atomic welding" forces, created during molding, between the agglomerated particles. Recrystallization and growth of the newly formed crystals are the most outstanding results of the sintering operation.

✦ ✦ ✦

THE products thus obtained are generally porous and are utilized when the porosity is a desired or essential characteristic. The main obstacle in the path of further wide-spread developments in the mass production of simple metallic parts by the use of powder metallurgical operations may be

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seen in the insufficient physical properties caused by abundant porosity and an unrefined structure of the sinter-metals. Certain properties, such as tensile, compressive and fatigue strength, hardness and electrical conductivity, are much dependent upon the amount or type of cavities left in the sintered body, and will approach normal values if the apparent density of the sintered metal comes close to the theoretical density of the particular material. Other properties, however, are mainly controlled by the specific conditions at the grain boundaries and by the character of the resulting structure, such as orientation of the crystals, and are generally low for sinter-metals. Tensile elongation and reduction in area, bending and torsional properties and particularly impact resistance are the chief components of the latter group.

✦ ✦ ✦

THE realization of these facts has been almost as old as the art of powder metallurgy itself, and it was only natural that attempts to refine the structure were made along the conventional lines of subsequent working, so well established in the case of gross metals. The manufacture of wires for tungsten, tantalum and molybdenum is the classic example of how the application of work can transform a fundamentally brittle material into a ductile wire or sheet of highest physical and chemical perfection. Only the laborious procedure of alternate working and annealing of the brittle sinter-bars finally creates wires spun out to fine and strong filaments with great resistance to shock and creep.

✦ ✦ ✦

THE example of the refractory metals indicates that most of the lower melting metals and many of the conventional alloys can be produced from metallic powders to the desired degree of metallization, provided that the necessary processing steps and the proper care during the manufacturing operations are taken. Whether commercial considerations may not exclude elaborate heat treating and working proceedings, is a different question, and it is fully realized that often a compromise is necessary between ideal processing conditions and commercial and industrial possibilities. This compromise, of course, has its bearing upon the qualities of the resulting metallo-ceramic products.

✦ ✦ ✦

THE object of the experiments described in the following was to adopt certain metal working methods used in the sintered refractory metal practice, for the manufacture of wires from a more common and lower melting metal. The experiments were made as part of a general investigation of structure and properties of compacts molded and sintered from copper powders.[1][2][3]

✦ ✦ ✦

IN order to permit certain simplifications of the metal working steps, the plastic metal copper was selected for the work. During these experiments any consideration in the direction of a possible industrial application of such procedure was left aside, and the wire-making schedule was entirely influenced by experience in handling such metallo-ceramic matters and by the equipment made available to the author.

✦ ✦ ✦

Raw Material and Experimental Procedure

TWO kinds of copper powder, electrodeposited and reduced, were used in this investigation as the raw material for making test specimens. Before being compacted to specimens, the powders were reduced at 300°C. for 2 hours in a steady stream of commercial hydrogen.

✦ ✦ ✦

THE dry electrolytic powders were of four standard grades, differing in particle size and apparent density. In this work they are designated by symbols "A", "B", "C", and "LC"; A is the coarsest; LC the finest and lightest. Table I gives their characteristics and specifications. The powder produced by reduction of copper oxides with city gas was of medium particles size. It is designated in this work by the symbol "R". Figs. 1 a and b are general views of the particles in powders A and R. The powders were compressed into a bar shape in order to obtain materials of different degrees of porosity.

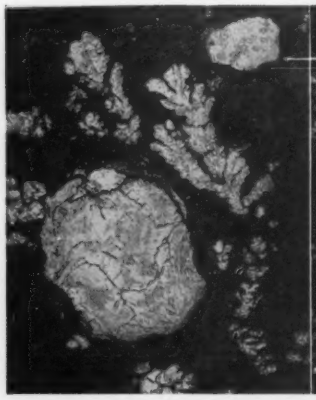


Fig. 1a. Electrolytic Coarse Copper Powder Type "A". X 200. ✦

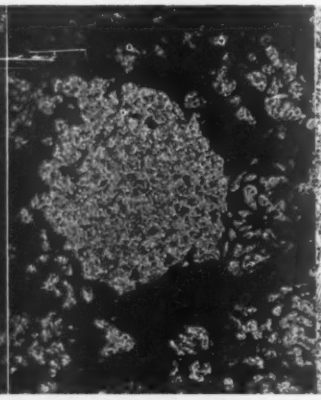


Fig. 1b. Reduced Fine Copper Powder Type "R". X 1000. ✦

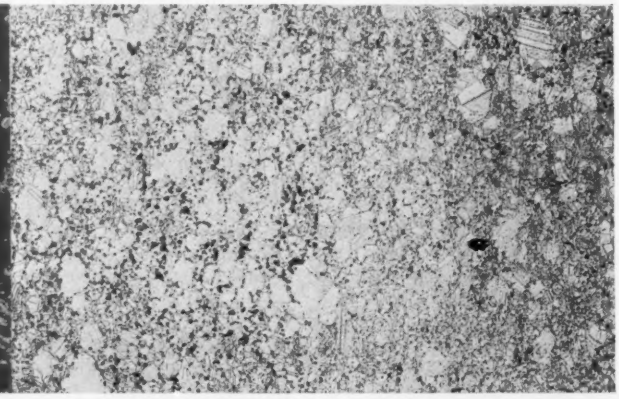


Fig. 1c. Compact from Copper Powder "B" Compressed at 45 ton/in² and Sintered at 750°C for 16 hours in Hydrogen. X 100. ✦

Fig. 1d. Compact from Copper Powder "B" Pressed at 45 tons/in² Sintered at 750°C for 16 hours in Hydrogen. Repressed at 45 tons/in², Resintered as above. X 100. ✦

THE pressure was varied from 5 to 45 tons per square inch and was applied by a 50-ton Watson-Stillmann hand-operated hydraulic press. All bars were sintered at 750°C. for 16 hours, but one set was heated in hydrogen, the other under vacuum. The sintering and annealing operations were carried out in a tubular electric resistance furnace. The specimens, supported by plates, were placed into a fused silica tube, and this was carefully closed and sealed. This furnace made possible heat treating in any desired atmosphere as well as in vacuum. In most cases heat treating was done in a stream of commercial hydrogen or under vacuum (pressure less than 1 millimeter). The furnace could be operated at temperatures from 300 to 1000°C., and the temperature was measured by means of an iron-constantan thermocouple.

✦ ✦ ✦

WHEN sintering was done under vacuum, the quartz tube was carefully washed with hydrogen before evacuation. The tube was left filled with hydrogen until the temperature reached 400°C., then the gas was evacuated and the furnace kept under vacuum as long as the temperature was above 400°C. When cooling the furnace, hydrogen was again introduced into the tube when the temperature dropped below 400°C., and was allowed to remain until the furnace was cold.

HALF of the compacts were subjected to a single compression followed by heating, the other half to a double-processing operation. In the latter case compacting and recompression pressures were varied, but annealing was the same as the initial sintering.

✦ ✦ ✦

FIGURES 1 c and 1 d show the microstructures of compacts of powder B, singly and doubly treated, respectively. Each compact, made according to one of these methods, was divided into two parts; one part was subjected to reduction by cold rolling without intermediate annealing; the other was annealed several times during the reduction.

✦ ✦ ✦

FOR annealing during rolling, the specimens were placed in a small electric furnace under a slightly reducing atmosphere (produced by charcoal). This furnace was mounted vertically on top of a pail of water, and the specimens were suspended in a wire basket. After heating, the basket was dropped into the water, thus quenching the specimens so that they would be dead soft. The annealing temperature was kept constant at 600°C. (within 20°C.) by means of a rheostat, and the temperature was measured with an iron-constantan thermocouple. The annealing time was 15 minutes.

✦ ✦ ✦

AFTER a reduction in area of approximately 97% by cold rolling, the wires were drawn through a draw-plate without intermediate annealings. The wires, as rolled had a square section, but this was transformed into a round section, 0.060 in. in diameter, by 12 passes through the draw plate (47% reduction in area). Half of the length of the finished wires was left in the hard drawn condition; the other half was annealed in an electric furnace at 600°C. for 1 hour. If the initial compacts were sintered in hydrogen, the wires were annealed in hydrogen; similarly, wires produced from compacts sintered under vacuum were annealed under vacuum.

✦ ✦ ✦

Rolling Ability of Compacts

DURING the experiments cold rolling was continued until cracks were plainly visible, and the reduction of area was then measured by means of a micrometer. This was taken as a measure of the malleability of the material.

✦ ✦ ✦

AS shown by Figs. 2 a and 2 b, various types of cracks occurred during these rolling tests. The three top specimens in Fig. 2 a and the sample of Fig. 2 b show cracks typical of those that occurred when the reduction was too rapid and too severe. Under these conditions the cracks run parallel to the axis of the bars, and in the direction of rolling. However, these conditions were unusual, and were generally avoided by using

Table 1: Copper Powders

Symbol	Commercial	Type of Powder	Grade	Apparent Density (Loading Weight) (gms/cm³)	
				Used Powders	Specification
A	50% oversize 50% A regular	Electrolytic dry	Very coarse particles, finer particles in small proportion.	3.49	4.0-4.5 2.5-2.8
B	B-regular	Electrolytic dry, commercial	Mixture of coarse and fine particles.	2.57	2.5-2.6
C	C-regular	Electrolytic dry, commercial	Majority of fine particles with very few coarser particles.	2.14	1.8-2.5
LC	LC-regular	Electrolytic dry, commercial	Fine particles, lower apparent density.	1.44	1.2-1.5
R		Carbon-Monoxide reduced dry, commercial	Uniform medium size of particles.	2.37	2.33

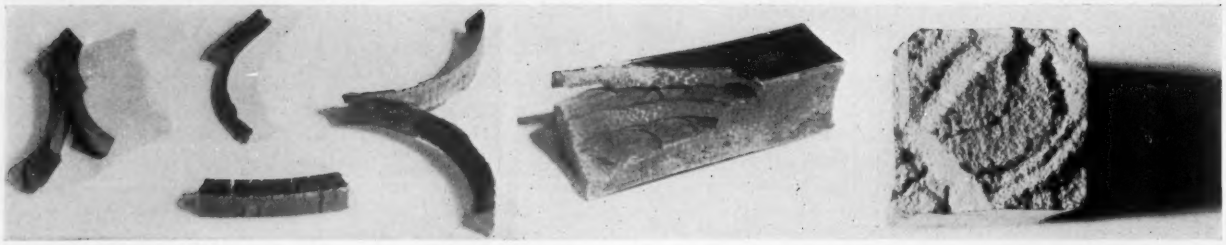


Fig. 2. Typical Failures of Sintered Copper Specimens During Rolling. ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦
a. Rolling Specimens with Different Types of Cracks. b. Rolling Specimen with Laminated Cracks. c. Typical Fracture of Rolling Specimen with Cracks Perpendicular to Rolling Direction.

an extremely low rate of primary reduction. This was especially true when the specimens were to be reduced without intermediate annealing. The rate of reduction was most generally 1/1000 in. in thickness per pass.

✦ ✦ ✦

THE lower specimen of Fig. 2 a shows a test piece with its crack perpendicular to the direction of rolling. This failure is typical of weak and imperfect material, too high in porosity. Figure 2 c shows a typical fracture perpendicular to the axis of the specimen. It seems that the material was more compressed in an outer zone by the rolling operation, and that the center core retained its original porous condition.

✦ ✦ ✦

THE influence of initial pressure on the reduction in cross-sectional area of the hydrogen-sintered compacts is shown in Fig. 3 a for reduction by direct cold rolling, and in Fig. 3 c for reduction with two to five intermediate annealing operations. Figs. 3 b and 3 d give the corresponding diagrams for vacuum sintered compacts. All specimens were subjected only to a single pressing and sintering operation prior to rolling. The heat treating was done at 750°C. for 16 hours. As the key indicates the broken lines of the diagrams refer to cast "OFHC" copper*) plotted for comparison.[4]

✦ ✦ ✦

EXCEPT for certain irregularities, the general trend is an increasing malleability with increasing molding pressures. In the case of hydrogen sintered specimens, C-powder compacts show a maximum at 10 tons per square inch and a minimum at about 20 tons per square inch. The reduced powder R gave the best results; it is the only powder which could be worked down to wires after a single compression at only 25 tons per square inch. Of the electrolytic powders, the coarsest material gave best results. The finer the particle size, the lower was the malleability. LC powder compacts gave the poorest results.

✦ ✦ ✦

IN the case of vacuum-treated material, the curves are even more irregular. LC powder compacts exhibit a distinct minimum malleability and show the worst performance. The effect of the different basic powders is much less definite than in the case of hydrogen-treated compacts. The reduced powder has lost its superiority as compared with the electrolytic powders. Generally speaking, the vacuum-treated compacts yielded a better malleability than the hydrogen-treated specimens, but in neither case could the compacts be worked down to wires by cold rolling without intermediate annealing operations.

✦ ✦ ✦

FIGURES 4 a to d give the corresponding diagrams for malleability tests on specimens compressed and sintered twice. The second pressing and sintering operations were exactly identical with the first. The general character of the curves for the repressed and resintered compacts is very similar to that of the curves for the singly compressed and sintered compacts but the malleability is uniformly much improved. Hydrogen-sintered and resintered compacts from reduced powder R could be successfully worked down to wires, even after compressing and repressing at only

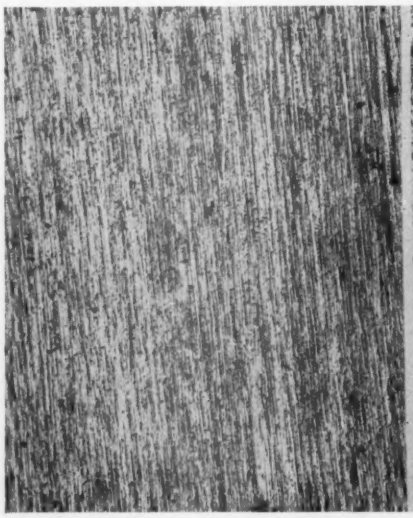


Fig. 5a. Hard Wire Cold Rolled and Drawn with Five Intermediate Anneals. Original Compact Made from Powder "A", Twice Compressed at 45 tons/in^2, and Sintered at 750°C for 16 hours in Hydrogen, X 200. ✦ ✦ ✦

Fig. 5b. Soft Annealed Wire Cold Rolled and Drawn with Five Intermediate Anneals. Original Compact Made from Powder "B", Twice Compressed at 45 tons/in^2 and Sintered at 750°C for 16 hours in Hydrogen. X 1000. ✦ ✦

*Oxygen-Free High Conductivity Copper.

15 tons per square inch. Compacts from coarse electrolytic powders, sintered and resintered in vacuum, could be rolled as readily as the R-powder compacts sintered in hydrogen. Only the fine electrolytic powder LC still revealed rather unfavorable tendencies. Its curves show a distinct minimum in the hydrogen case as well as in the vacuum case, and also remarkably low malleability values. The curves for the cold-rolled A-powder compacts (Fig. 4 b), shows an outstanding maximum and minimum at low pressures. This seems to be based on certain inconsistencies in the test values rather than on any particular characteristic of the material. Of the compacts sintered in hydrogen only the one molded

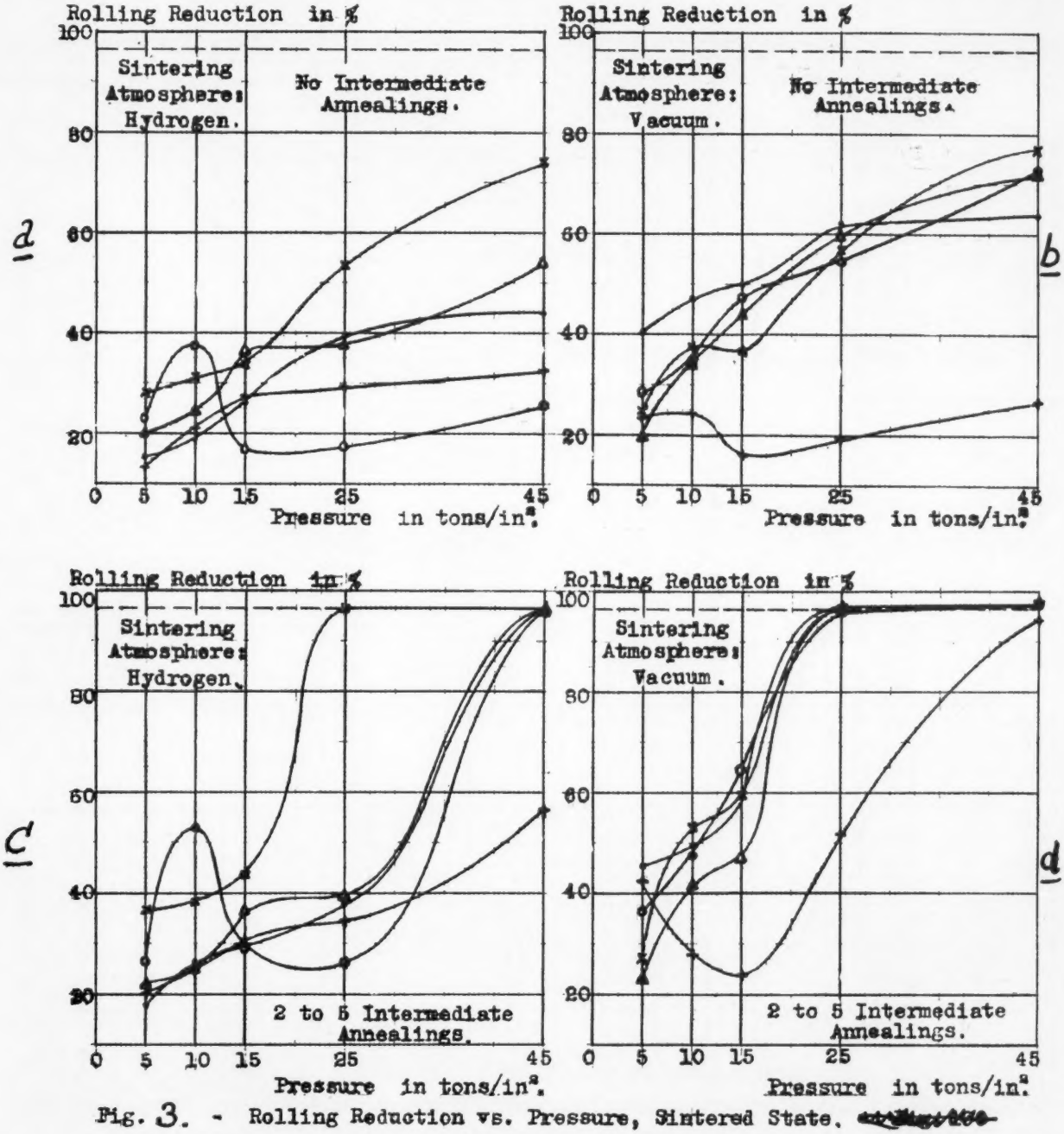


Fig. 3. - Rolling Reduction vs. Pressure, Sintered State.

from R-powder, compressed and repressed at 45 tons per square inch, could be worked down to wire by direct reduction. Of the vacuum treated compacts, all those compressed and repressed at 45 tons per square inch could be reduced without intermediate annealing, except the one made of the LC powder.

+ + +

Structure and Properties of Wires

Structure

IN all hard drawn wires, the grains are strung out into fine fibers, while in the annealed specimens the grains are equiaxed (see Fig. 5 a and b). The type of powder has only a slight influence on the structure of the wires, namely coarse powders produced somewhat coarser fibrous and

(*Please turn to Page 239*)

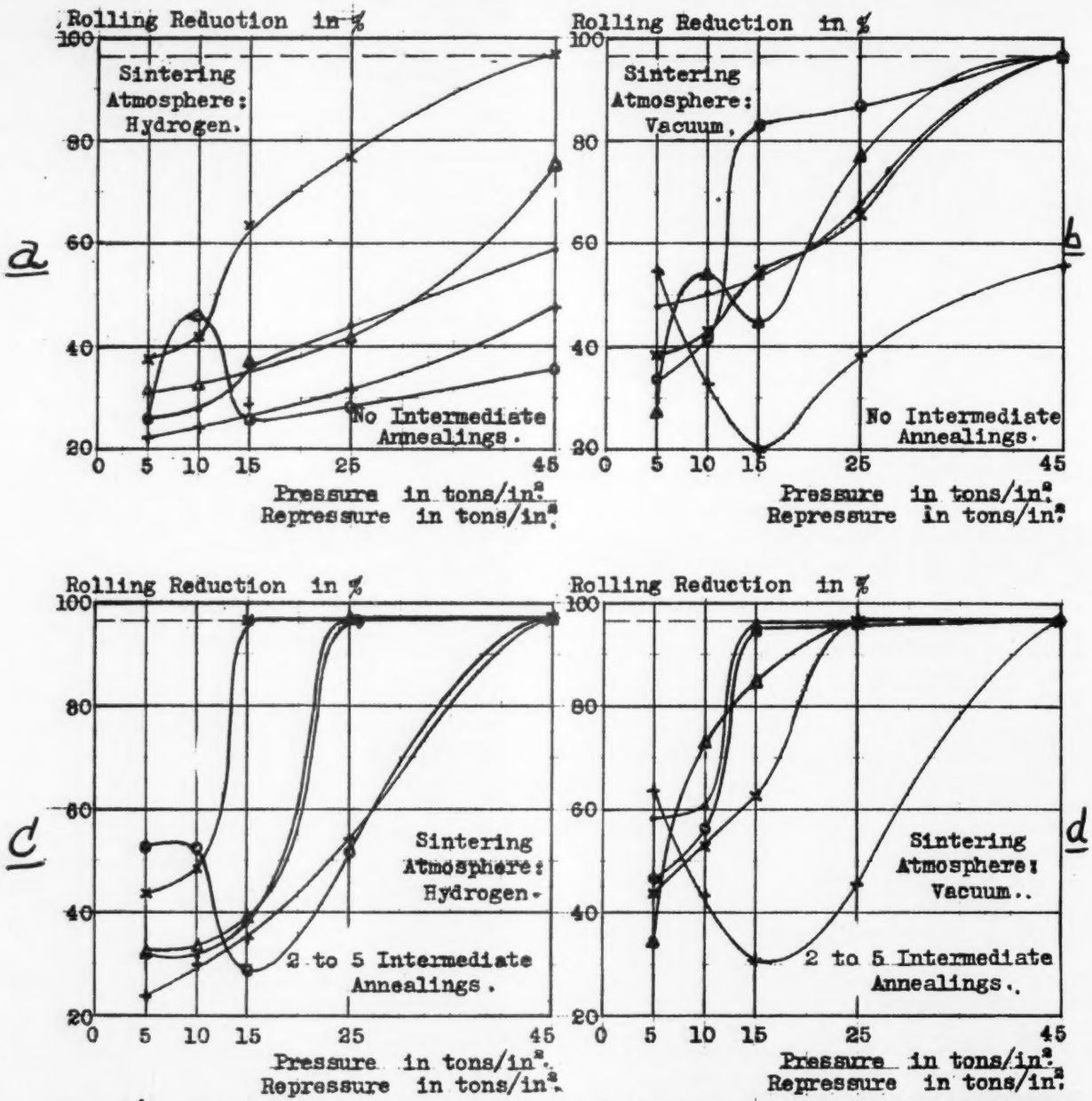


Fig. 4. - Rolling Reduction vs. Pressure, Sintered and Repressed State.

The Mechanics of the Torsion Spring

PART II.

By Robert L. Adams,
Barnes-Gibson-Raymond Div.,
Associated Spring Corp., Detroit, Mich.

THE bearing mounts are set up on a heavy I-beam so that the entire machine was very rigid and could carry heavy torques without deflection occurring in any of the machine parts. The assembled machine and the set up for holding the two different types of ends are shown in the accompanying photographs.

✦ ✦ ✦

TWO types of tests were run. For checking deflections, loads were applied in one pound increments up to a total of ten pounds. Deflections were tabulated and since the load and lever arm were known, the torque M could be calculated. By substituting the known value for M into Eq. 32, the theoretical value for the number of turns of rotation n may be calculated and compared with the experimental result.

✦ ✦ ✦

THE simplest method of checking stresses is to successively wind the spring up and relax it again, increasing the angle of rotation by increments of 5° or 10° each time, until the protractor no longer returns to zero when the spring is relaxed. This amount of rotation is then the amount necessary to cause the first slight permament deformation and may be regarded as the elastic limit, as defined on page 17.

✦ ✦ ✦

IN considering the application of the deflection equation to the experimental results we can first develop an interesting equation, which if it is satisfied by our observed deflections, will further back up our contention of a pure moment M.

✦ ✦ ✦

FIG. 13 (a) shows a half coil loaded as it is loaded in the testing machine. Fig. 13 (b) shows all three loads which could occur at point A. The loads are:

1. **A radial shear force F_s which can have no effect on the deflection since the end of the spring is built in to the arm.**

✦ ✦ ✦

2. **A tangential force P, whose moment on arm**

$$OC = \frac{PD}{2}$$

3. **A moment M which is constant throughout the length of the coil.**

The moment M and the tangential load P then are the factors which would affect the deflection. The relative magnitude of M and P cannot be determined without two equations since by building in the ends we have a redundant beam.

FROM statics we know that

$$M' + \frac{PD}{2} = M = W\ell \qquad (33)$$

the applied moment since the shear force S can produce no moment.

✦ ✦ ✦

WE also know that

$$\theta = \theta_1 + \theta_2 \qquad (34)$$

where θ_1 is the angle of rotation caused by the moment M′ and θ_2 is the angle of rotation caused by PD/2.

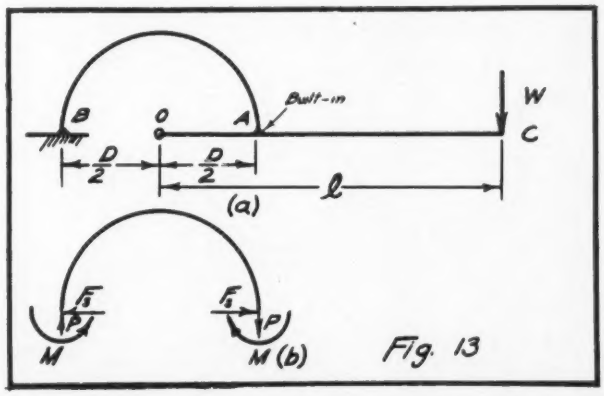
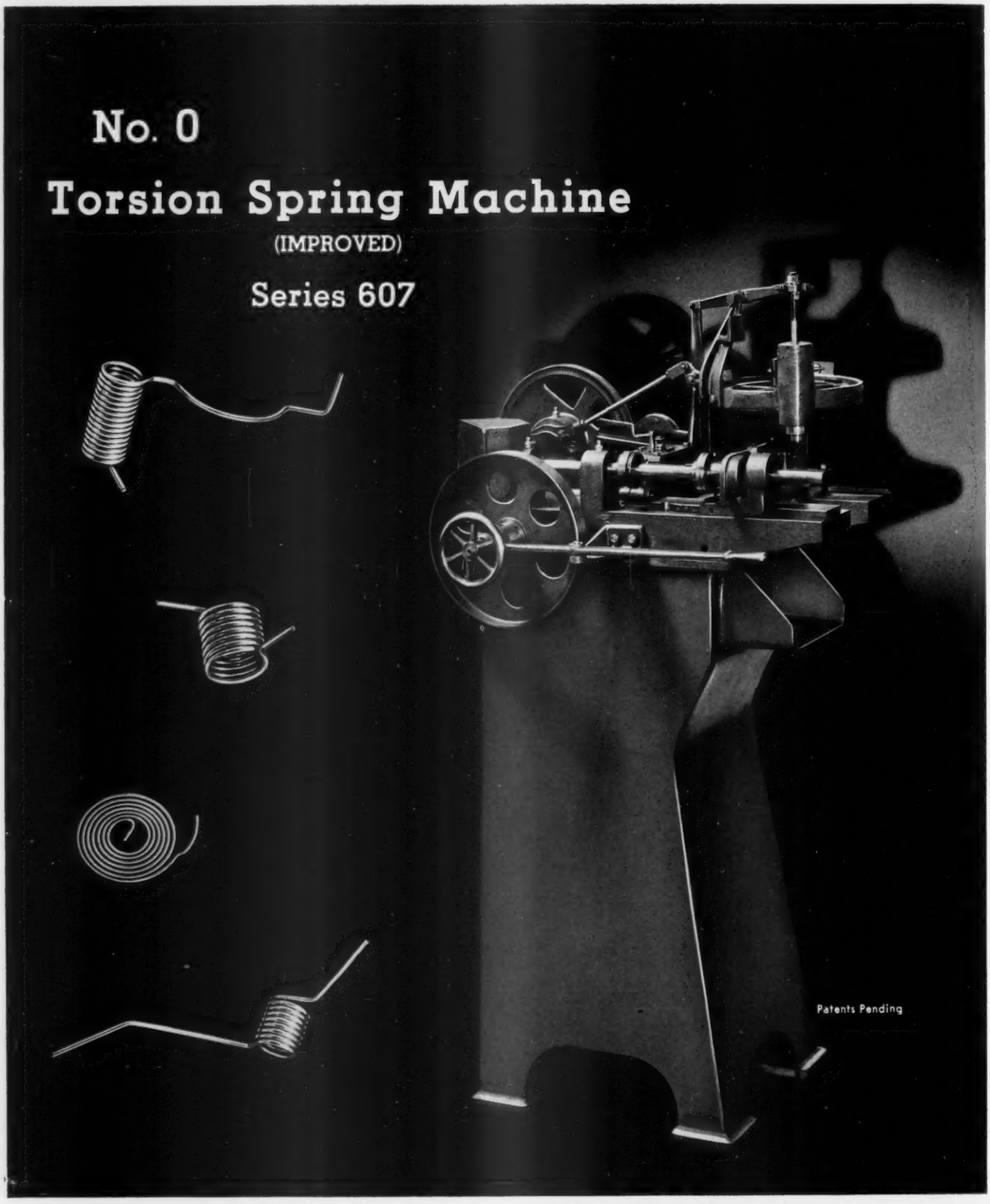


Fig. 13

Glossary of Symbols Used

n	=	number of turns the spring is rotated
D	=	pitch diameter of the spring
N	=	number of coils of active wire in the spring
M	=	applied moment in inch-pounds
E	=	modulus of elasticity in tension (Value of 29,000,000 used in this paper)
d	=	wire diameter
S_I	=	fibre stress at inside of coil
S_o	=	fibre stress at outside of coil
c	=	distance from extreme outer fibres to neutral axis. (For straight beams of circular cross section c = d/2.)
C	=	D/d and is called the index of curvature or spring index
I	=	moment of inertia of the cross section (for circular cross section $= \frac{\pi d^4}{64}$)
K_I	=	curvature correction factor for stress at inside of coil
K_o	=	curvature correction factor for stress at outside of coil
K	=	curvature correction factor for deflections
e	=	distance of neutral axis from center of gravity of cross section
θ	=	angle of rotation expressed in radians



SLEEPER & HARTLEY, Inc.

DESIGNERS AND BUILDERS

WORCESTER, MASSACHUSETTS, U. S. A.

FROM Eq. 23

$$\theta_1 = \frac{\pi DNM}{EI} \qquad (35)$$

+ + +

FROM energy considerations

$$\theta_2 = \frac{\delta}{R} = \frac{1}{R} \times \frac{\partial V}{\partial P} \qquad (36)$$

where V is the strain energy of bending

$$V = \int_0^{\pi} \frac{M^2 R d\theta_2}{2EI} = \int_0^{\pi} \frac{P^2 R^2 (1-\cos\theta_2)^2 R d\theta_2}{2EI}$$

then

$$\theta_2 = \frac{1}{R} \frac{\partial V}{\partial P} = \frac{PR^2}{EI} \int_0^{\pi} (1-\cos\theta_2)^2 d\theta = \frac{3\pi PR^2}{2EI} \qquad (37)$$

Letting $R = D/2$

$$\theta_2 = 3/8 \times \frac{\pi PD^2}{EI}$$

and extending the integration to N active coils we have

$$\theta_2 = 3/8 \times \frac{\pi PD^2}{EI} \times 2N = \frac{3\pi PND^2}{4EI} \qquad (38)$$

Substituting Eqs. 35 and 38 into Eq. 34 we have

$$\theta = \frac{\pi DNM'}{EI} + \frac{3\pi PND^2}{4EI}$$

and by factoring

$$\theta = \frac{\pi DN}{EI} \left[3/2 \left(\frac{PD}{2} \right) + M' \right] \qquad (39)$$

From Eq. 33

$$\frac{PD}{2} = M - M'$$

and substituting this value of $\frac{PD}{2}$ into Eq. 39

$$\theta = \frac{\pi DN}{EI} \left[3/2 (M - M') + M' \right]$$
$$= \frac{\pi DN}{EI} \left[3/2\, M - M'/2 \right] \qquad (40)$$

Now returning to our original contention that Eq. 23 is correct and that we have no tangential force, we can substitute Eq. 23 into Eq. 40 and

$$\frac{\pi DNM}{EI} = \frac{\pi DN}{EI} \left[3/2\, M - M'/2 \right]$$
$$M = 3/2\, M - M'/2$$
$$M' = M$$

therefore

$$\frac{PD}{2} = 0 = P \qquad (41)$$

IT is interesting to note that if experimental values of θ instead of values calculated by Eq. 23 are put into Eq. 39 and solved simultaneously with Eq. 33 for the tangential force P, a finite value for P may be obtained. The value for P obtained in this manner is dependent upon the difference between the experimental deflection and the deflection calculated by Eq. 23. This difference varied from as low as .25% to as much as 10.0%. In general the springs held with the chuck type ends agreed more closely with the theoretical deflection than did those with the arbor type ends. The reason for this is believed to be the fact that variations in the diameter of the spring caused poor fits on the arbor in some instances. A loose fit on the arbor necessitated a small preload to take up the slack and this somewhat increased the number of active coils. This would result in a greater deflection than calculated.

+ + +

THE error, then, can be attributed to either experimental error, the existence of a very small tangential force P, or both. Since it is known that the larger errors occurred under uncertain end conditions, it seems safe to call P negligible.

+ + +

TABLE A shows sample results for deflection tests. The value for E used in all calculations is 29×10^6. This value was determined experimentally and found to be practically the same for both music wire and oil tempered wire.

TABLE A

Index	Wire Dia.	No. active Coils	Test Deflec. (Degrees)	$\theta = \frac{10.18DNM}{Ed^4} \times 360$	Deviation %
16	.126"	8.5	207.8	207.2	+ .29
16	.126"	4.5	110.1	109.8	+ .273
8	.126"	8.5	107.9	103.9	+3.85
6	.126"	8.5	80.7	79.0	+2.15
4	.126"	8.5	54.4	53.0	+2.59
3	.126"	8.5	43.8	40.2	+8.95

THE error runs larger for the lower indices due to the fact that all springs with an index of 3 or 4 were tested on the arbor type ends and proper fits were harder to obtain with these lower indices.

+ + +

IN commercial practice it would be expected that end conditions would vary somewhat and that fits would not be as perfect as is possible to get in experimental work. Friction between the coils of a close coiled spring would also cause a load loss. It has been found from experience that if the constant 10.18 in Eq. 32 is increased to 11.25, about a 10% increase, better practical results are obtained. The experimental tests show that this 10% increase is a good approximation in allowing for such variations.

+ + +

THE agreement between test results and calculations was about the same for unwinding as for winding up. However, the amount of deflection over

which the equation holds is greatly dependent on whether or not the spring is heat treated after coiling. This will be discussed when we consider stress conditions.

✦ ✦ ✦

THE problem of calculating stresses is a much more complicated one than that of calculating deflections, due to the difficulty of obtaining a reference point at which the stress is definitely known. As stated before, the elastic limit is the simplest point to determine. The only other method is to use an extensometer, which would be extremely difficult if not impossible to use accurately on a complete spring.

✦ ✦ ✦

FAILURE in bending always takes place on the tensile and not the compressive side of the bar. This has been found to be true for torsion springs in spite of the fact that the compressive stresses on

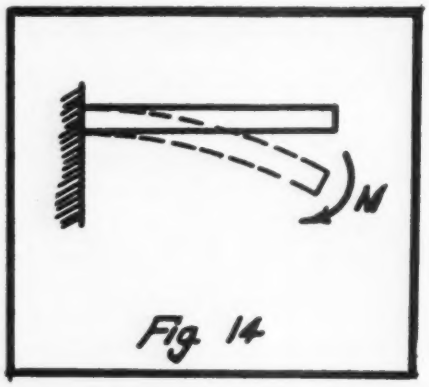
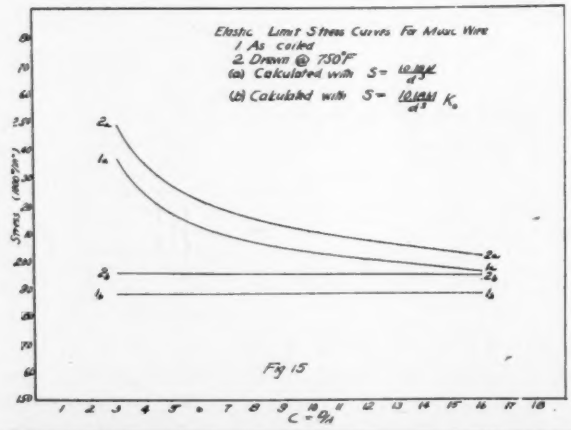


Fig 14

the inside of the coil are higher than the tensile stresses on the outside. This tensile stress is then the limiting stress for a spring being wound up and we are concerned with the elastic limit in tension in making our measurements.

✦ ✦ ✦

THE term elastic limit is a trouble maker because there are numerous empirical methods of determining it and much disagreement on which



method to use. In this discussion we will use elastic limit as the stress at which the beam of a tensile machine drops when pulling a specimen of the wire. This is a method commonly used commercially and is as good as any other for the purpose. Figures obtained by this method are used as elastic limit stresses and they agree with the regular commercial specifications for the material used.

E. L. In Tension of Wire Used

Music	**200,000#/sq. inch**
Oil Tempered	**180,000#/sq. inch**
Annealed Wire (Hardened & drawn)	**180,000#/sq. inch**

✦ ✦ ✦

THE elastic limit of the music wire drawn at 400 degrees was slightly higher, that drawn at 750 degrees was slightly lower.

✦ ✦ ✦

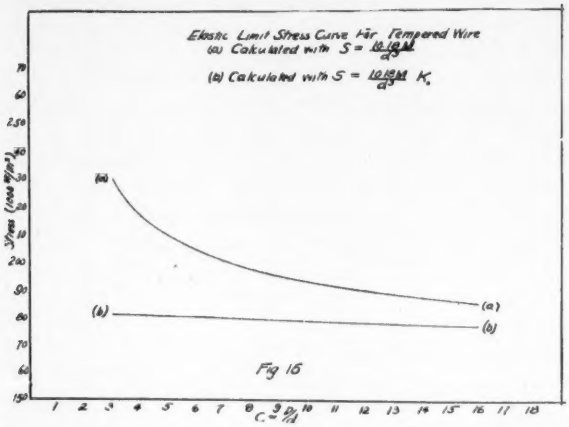
THE first elastic limit tests were made on a basis of 1 degree of permanent deformation and it was found that stresses calculated for a deflection corresponding to this amount of set were much too low. It was then decided that 1 degree of set was a much more sensitive measurement than the tensile determinations made on the wire. Since 1 degree was merely an arbitrary figure, being the smallest consistent unit easily measurable, a large amount of set was tried with the following ideas in mind.

✦ ✦ ✦

IF a straight cantilever beam is loaded with a pure moment at the end, as in Fig. 14, failure would be expected when the tensile stress on the top of the beam reached the elastic limit stress. It would also be expected that a curved beam would approach this same condition as the curvature decreases. We considered then that for springs with an index as great as 16, the calculated stress for the elastic limit of the spring should be fairly close to that which would be calculated for a straight beam, which in turn would be close to the elastic limit of the wire as pulled in the tensile machine. This would be true for springs which were quenched and drawn after coiling so that no residual stresses are present. It was found that a set of 3 degrees gave a figure of about 195,000#/sq. inch for drawn music wire springs with an index of 16. This amount of set is usually permissible in most commercial applications.

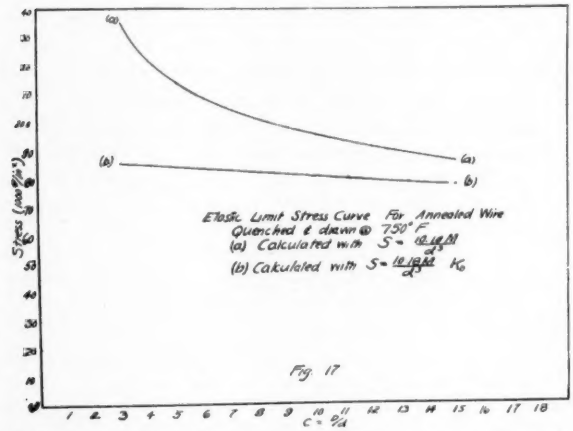
✦ ✦ ✦

FIG. 15 shows a stress—index curve for music wire drawn at 750 degrees F. The upper curve is the stress calculated from experimental values of M or T, the torque, and the deflection using the straight beam equation. It can be seen from this curve that if the straight beam equation is used, the elastic limit stress is apparently much higher for springs of a low index. This cannot be true since all stresses due to cold working were removed by the heat treatment and most, if not all, of the quenching stresses have been relieved by the draw. From this

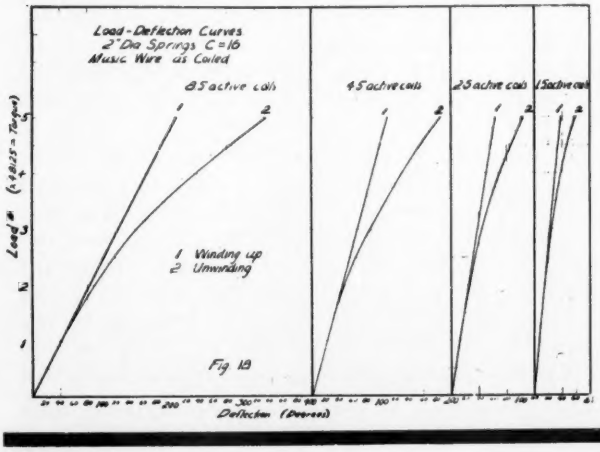


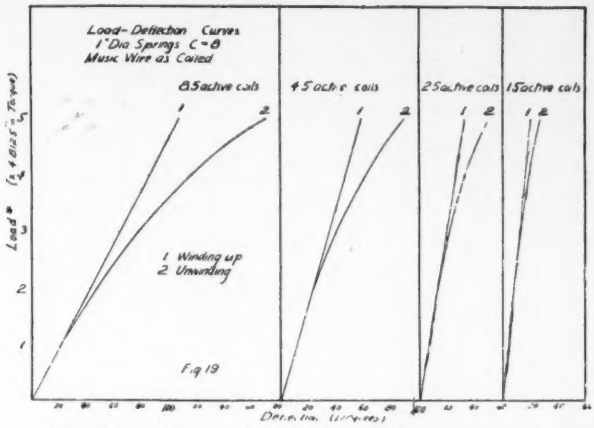
we would expect a horizontal line showing that springs of all indices have the same elastic limit and if the correction factor K_o is now applied to the upper curve we get this horizontal line as shown in Fig. 15. The curves for the other materials were also obtained in this manner. It is interesting to note that the shape of the curve is not materially affected if no heat treatment is used, although the absolute values vary according to the effect the heat has on the elastic limit.

✦ ✦ ✦


Elastic Limit Stress Curve For Annealed Wire
Quenched & drawn @ 750° F
(a) Calculated with S = 10.18M/d³
(b) Calculated with S = 10.18M/d³ K₀
Stress (1000 lbs/in²)
(a)
(b)
C = D/d
Fig 17

AT first glance this upper curve may appear useless because it is theoretically wrong, but a little study brings out some interesting facts. It





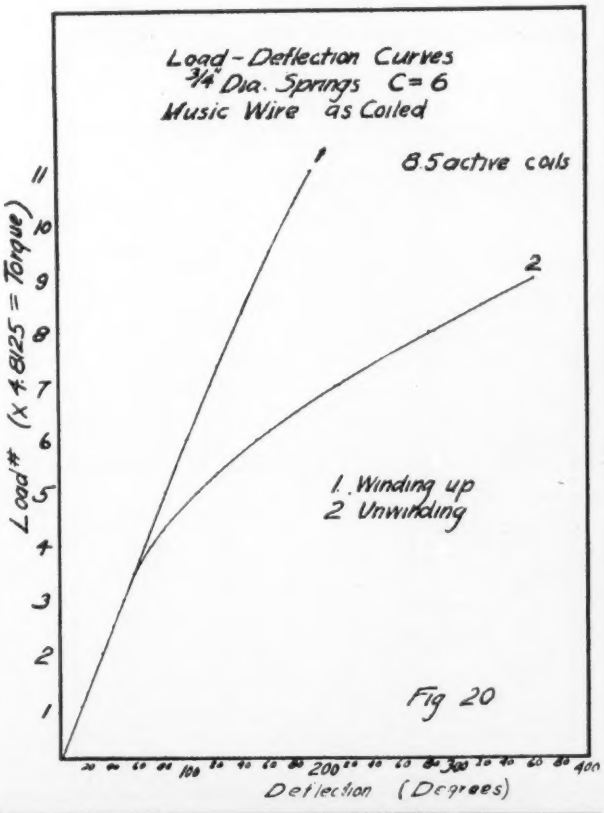
should be evident that although the true elastic limit stress is constant for all indices, the load carrying ability is not constant, but increases with the smaller indices for the same wire size. It is also evident that the deflection is dependent on this apparent stress instead of the true stress. This does not mean that the deflection-load relationship is changed, but does mean that the springs of lower indices will develop higher loads without setting than will springs of higher indices of the same wire size.

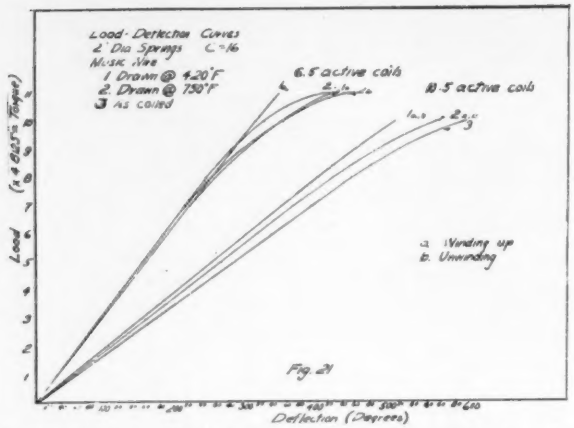
✦ ✦ ✦

THESE facts will be made clear from the stress and deflection equations. From Eq. 18

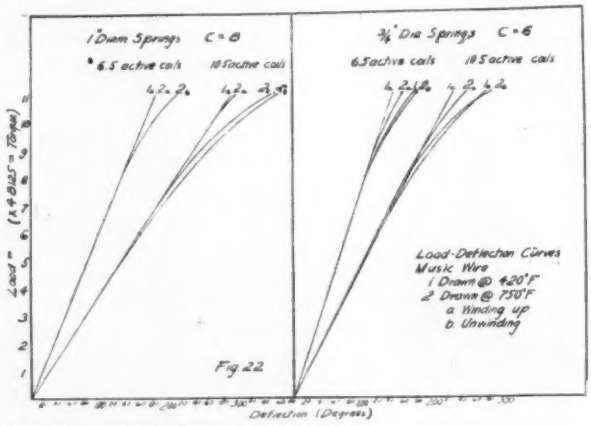
$$S_o = \frac{10.18\,M}{d^3}\ K_o\,, \qquad (18)$$

✦ ✦ ✦





it can be seen that for a given stress and wire size the moment M becomes greater for smaller indices. Now by solving for M in Eq. 18 and substituting into Eq. 32 we see that for a constant wire size the number of turns of rotation n does not decrease in direct proportion to the spring diameter

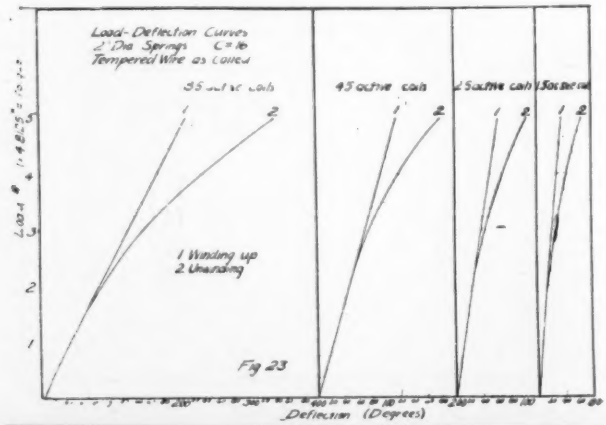


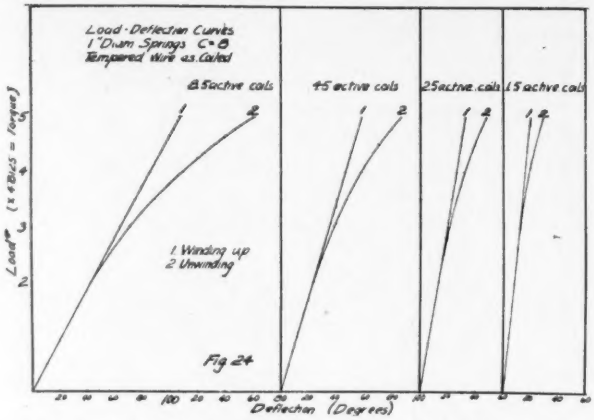
because of this increase of M

$$n = \frac{10.18\ DNM}{E\ d^4} \qquad (32)$$

$$M = \frac{S_o\ d^3}{10.18\ K_o}$$

$$n = \frac{DN}{Ed} \times \frac{S_o}{K_o} = \frac{C\ N}{E} \times \frac{S_o}{K_o} \qquad (42)$$





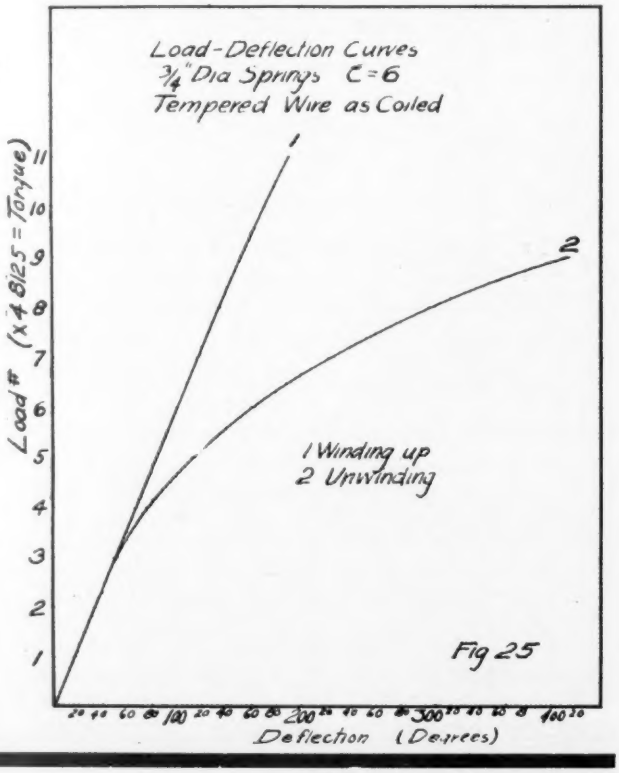
EQ. 42 is a convenient form for calculating deflections where the desired stress is already known. It is important to remember that the stress S_o is a true stress, the limiting value of which is the elastic limit in tension of the wire.

✦ ✦ ✦

HEAT treatment affects the torsion spring in two ways. The first is the effect upon the elastic limit, and the second is its effect on coiling stresses or stresses due to cold work. Comparative curves for the effects of heat treatment on stress are shown in Figs. 16 and 17.

✦ ✦ ✦

THE existence and magnitude of coiling stresses is very important when considering the ability of a spring to unwind. A brief description of the mechanism by which they are believed to be formed will be of some help in understanding the effect of



heat treatment on stress conditions in a spring being unwound.

✦ ✦ ✦

WHEN the wire is coiled into a spring the outer fibres are stressed considerably above the elastic limit in order to produce the necessary permanent deformation. However, fibres nearer to the neutral axis are still within the elastic limit and thus after the coiling load is removed they cannot return to their initial position because of the permanent deformation which has taken place in the outer fibres. The exact distribution of stresses caused by this condition is not known. There would be tensile stresses on the fibres which could not return to their initial position and these would cause compressive stresses in the outer fibres which were permanently deformed. In all probability the reverse of this condition exists on the inside of the neutral axis, although the permanent deformation on the compressive side is much smaller than that on the tensile side. The result is that we have tensile and compressive stresses on both sides of the neutral axis with the extreme outer fibres being in compression and the innermost fibres being in tension. This condition would appear to be favorable to winding a spring up since considerable rotation might be possible before these inner and outer fibre stresses are brought to zero and then reversed with further rotation. In the actual testing the springs which were not heat treated show little difference as compared with the heat treated springs. This is probably caused by the opposite stresses existing closer to the neutral axis. These stresses, combined as a whole then, seem to have little effect on the properties of a spring being wound up.

✦ ✦ ✦

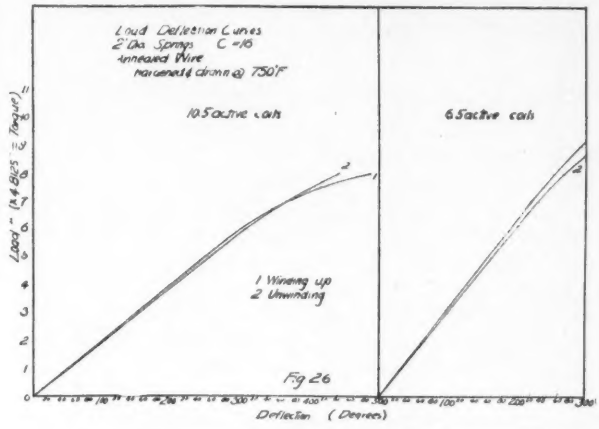
THE stress condition described above is very unfavorable to unwinding since the existing stresses in the inner and outer fibres are the same as those induced by rotation. Load deflection curves for the unheat-treated springs are shown in Figs. 18-20 and Figs. 23-25.

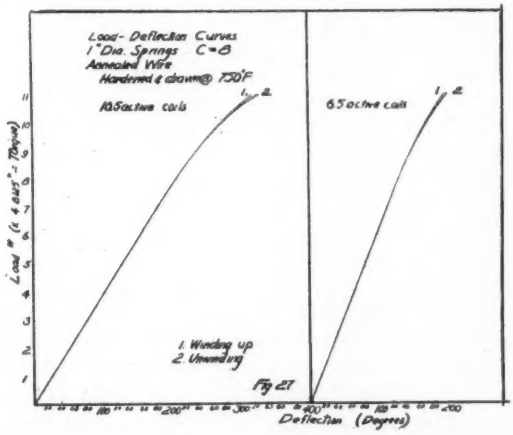
✦ ✦ ✦

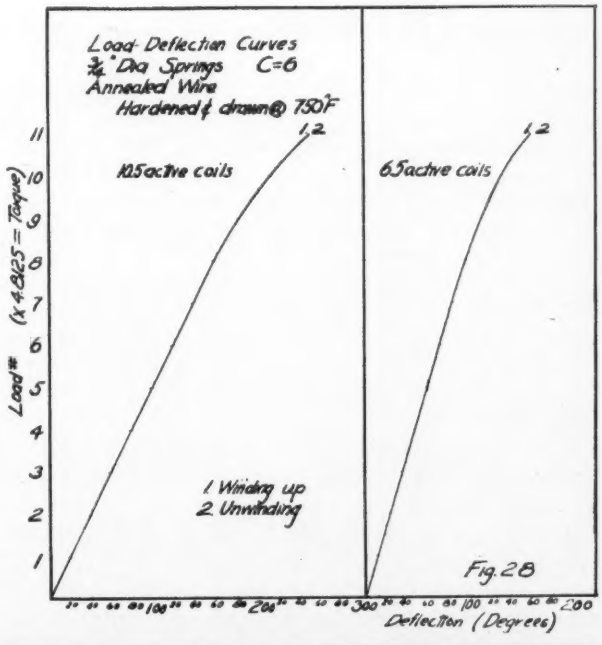
ACCURATE stress curves for the point of set were not determined as the results were not very consistent. Approximate calculations show a stress of 60,000-70,000#/sq. inch for the point where the springs begin to set. This would indicate residual tensile stresses in the neighborhood of 120,000#/sq. inch but the exact distribution of these stresses is beyond the scope of this paper and would require much further experimental work.

✦ ✦ ✦

FIGS. 21, 22 and Figs. 26, 29 show the effect of heat treatment on these residual stresses. They are not completely removed in the music wire as 750 degrees F. is not sufficiently high to allow a complete readjustment, but they are sufficiently removed to allow a spring to be used unwinding if this is desirable. Complete removal would be impossible without excessively lowering the physical properties of the music wire. The stresses are completely removed by quenching and drawing the annealed wire. The curves show this very plainly. These heat treated springs set at a lower value when being unwound because it will be remembered that the maximum stress occurs on the inside of the coil. For this type of loading it now becomes the tensile stress in







which we are interested when considering the elastic limit. Since the correction factor K_1 becomes greater as the index decreases, the effect is the opposite to that for winding up. That is, the load carrying ability decreases with a decrease in index and the apparent stress becomes less than the true stress at the elastic limit.

✦ ✦ ✦

THIS paper has attempted to investigate thoroughly the basic theoretical mechanics of stress and deflection in the torsion spring. There are other factors to consider in the design of torsion springs, such as allowable variations in load, arbor sizes, shape of ends, etc., but these are outside the fundamental aim of this work. It should be emphasized that the equations developed here are believed to be theoretically correct, but that they can only be as accurate as the parts of which they are made up. Variations mentioned earlier in this article will decrease the accuracy and commercial work cannot be expected to approach experimental results in this respect.

✦ ✦ ✦

FINALLY, it must be remembered that these tests were all for a condition of static loading. No fatigue testing has been done on torsion springs to the knowledge of the writer. Considerable work has been done with rotating beam type tests which give a complete bending stress reversal, but tests of actual springs might give some interesting information, particularly in the case of heat treated springs which can be rotated either way, this information would be useful. We have been able to show that a heat treated spring can be unwound, but can make no prediction as to the endurance limits, or as to how such endurance limits would compare with those for winding up, as for going from one extreme through zero to the other extreme. These problems, and that of establishing the actual stress distribution in a spring not heat treated after coiling are interesting material for future investigations.

✦ ✦ ✦

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NOTE: The following corrections should be applied to the equations indicated.

Equation (7)— $= A$ should be $= A_e$

Equation (12)— $R\frac{m}{1+M}$ should be $R\frac{m}{(1+M)}$

Equation (19)— $= \int_o \pi$ should be $= \int_o \pi P$

Equation (29)—Line should be eliminated between the first and second part of the equation.

Equation (31)— $\frac{e}{2H}$ should be $\frac{e}{2\pi}$

Equation (39)— $\left(\frac{10}{2}\right)$ should be $\left(\frac{PD}{2}\right)$

Fine Die Policy Announced By Office of Production Management

IN connection with the article appearing on page 232 entitled "Survey of the Fine Die Problem," an investigation was made to determine the correctness of the statements made and as a result the data appearing on page 240 entitled "Diamond Wire Drawing Dies in Defense" was gathered by the publisher of WIRE & WIRE PRODUCTS.

✦ ✦ ✦

IN view of the difference of viewpoint, the matter was then taken up with the Office of Production Management for clarification with the result that the following authoritative information on the subject of fine diamond wire drawing dies may be presented.

✦ ✦ ✦

MR. ALEXANDER SHAYNE, of the Office of Production Management, under date of March 27, 1941 states: "We submit for your consideration, the facts gathered by us with regard to the diamond die situation today and the proposals advanced for the overcoming of the shortage of fine diamond dies which threatens.

✦ ✦ ✦

1. WE have conducted a comprehensive investigation of the needs of the American wire drawers and have ascertained that their yearly requirements amount to a minimum of 7500 dies in sizes between .00039" and .0015". This information was supplied to us by ten wire drawing firms. Two large firms advised that their available supply of dies below .0015" will carry them through for at least twelve months. If we should extend the size range of diamond dies to .002", the yearly minimum requirements would be considerably above the figure of 7500.

✦ ✦ ✦

2. A MEETING of diamond die manufacturers was held in Washington on December 4th,

(*Continued on Page 238*)

ANNUAL
PITTSBURGH REGIONAL MEETING

William Penn Hotel, Pittsburgh, Pa.

THURSDAY, APRIL 17th, 1941

DINNER AT 6:30 P. M.

Guest Speaker—Lt. Col. Scott B. Ritchie,
Ordnance Dept., U. S. Army

Topic:

"Government Inspection of Military Material"

Following the Dinner—Paper and Discussions
"Government Inspection"
"Cold Heading Materials"

There will be a registration fee of $2.50 including the dinner preceding the technical meeting. Mail your reservations in today to

RICHARD E. BROWN, Executive Secretary

THE WIRE ASSOCIATION

300 MAIN STREET **STAMFORD, CONN.**

Survey of The Fine Die Problem

By Paul L. Herz,
Technical Advisor and Manager,
Belgian Tool Co. (Malines, Belgium)

An examination of the position of the diamond die industry in the light of emergency conditions. The opinions expressed in this article should be considered as those of the author individually and as not necessarily reflecting the opinion of the Editor of WIRE & WIRE PRODUCTS.
See editorial on Page 240.

THE cessation of the import of fine diamond dies from Europe due to the war has been the source of great anxiety to the makers of fine or capillary wire for many industrial purposes such as electric lamps, radio tubes, fine wire for metallic cloth used in the manufacture of chemicals, laboratory work, insulating and plastic material, etc., etc.

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THIS anxiety seems to have reached the National Defense Board in Washington and a meeting of all die makers in this country was called in Washington towards the end of the month of December. I do not believe that a concrete plan of action emerged out of this meeting, and I suggest that due to the great complexity of the problem the difficulties of the case may well not have been brought out with sufficient clarity to reveal the seriousness of the situation.

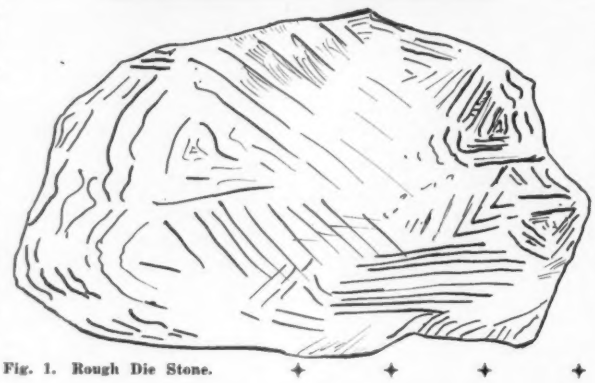

Fig. 1. Rough Die Stone. ✦ ✦ ✦

✦ ✦ ✦

THE American die making industry is not large. It consists, at the utmost, of a few dozen recently expanded small plants. These shops are mostly specialized in the manufacturing of larger diamond dies—that is, from .010 upwards. It must also be stated that a substantial part of the production of these plants is devoted to the making of tungsten carbide dies. The trained personnel in this industry is very small and very few, if any, among the workmen can be said to have enjoyed professional training.

✦ ✦ ✦

AS the industry now stands, it may be able to take care of most of the needs of American industry for larger dies from .010 upwards, but it is insufficiently developed to also satisfy the big demand coming from warring and friendly neutral nations which now look to us for supplies.

✦ ✦ ✦

HOWEVER, the bulk (in numbers) of the quantity of dies needed, runs from .010 down to .002 and then into the finer or capillary sizes, that is; from .0019 down to .00039. While the existing plants may be able to push their production down to finer sizes as low as .006 and in some cases to .002, it can be asserted that the amount of dies that can be produced between .006 and .002 will fall very short of the national needs, let alone the export needs.

✦ ✦ ✦

AS a matter of self interest, whatever increased production can be expected from manufacturers through the training of additional men will be devoted to the production of the larger dies. These can be made quicker, with much less trouble, and at a greater profit. As for the dies running from .002 to .00039 (capillary dies) the prospects of production are hopeless under the existing conditions.

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IT can thus be expected, should the war last much longer, that

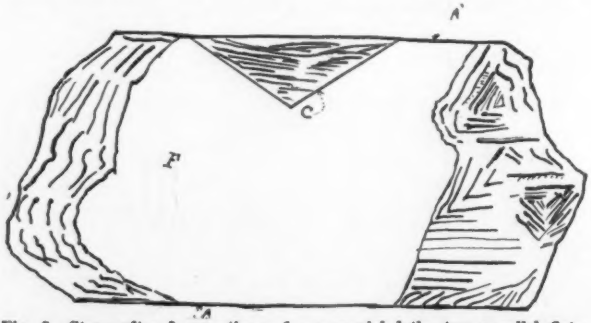


Fig. 2. Stone after 3 operations. 1. on special lathe two parallel flats A & A' are ground with a bortz diamond. 2. a "window" F is lapped on a diamond cutter's wheel to enable driller to follow progress of drilling 3. a "center point" is cut into the stone on special lathe—stone ready for drilling. ✦ ✦ ✦ ✦ ✦ ✦

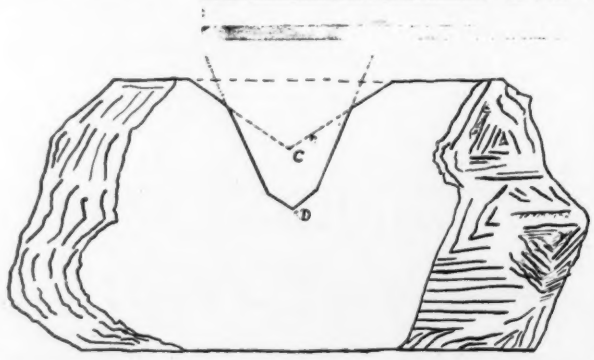


Fig. 3. "D" first point of advance of drilling. ✦ ✦ ✦

the time must come when our fine wire industry will be completely stopped through the shortage of fine dies. In order to clarify the situation it is well, for the guidance of those interested, to delve into the difficulties involved in the hope that it may direct their efforts towards the real and practical solution of the problem.

✦ ✦ ✦

The Manufacturing of Fine Dies

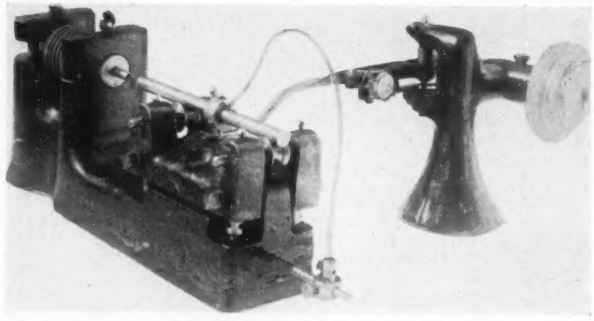
THE drilling of diamond which is crystallized carbon and the hardest known material in the world, relies upon the only practical principle known "wear by abrasion." By the means of a revolving and peckering instrument, a steel needle in this case, which acts as a carrier for the abrasive diamond powder, a hole is abrased into the crystal.

✦ ✦ ✦

THE practical way of doing this work is to use a specially built precision lathe, the chuck of which revolves at high speed and holds the drilling needle. This needle after being shellacked and centered into the chuck is then ground to proper shape. Facing this chuck and moving in the same axis is a steel holder carrying the diamond and moving freely back and forth, supported by two small grooved idlers. This holder hurls the diamond with controlled velocity and frequency against the needle.

✦ ✦ ✦

THE needle should carefully be centered in the chuck while the shellac hardens and then ground to form with a portable grinding contraption while the workman follows the progress of the grinding through a magnifying glass. Diamond being much harder than the hardest steel, the needle will wear quickly so that it has to be re-shaped very frequently. It does look as if it were easier to replace the needle when worn by one ground to shape beforehand, and thus mechanize this work which requires great skill and practice. Unfortunately, once the needle has been shellacked in the chuck it cannot be removed and replaced in the exact axis of the drilling already done. It must be borne in mind that in what we call fine dies (from .007 down to .002) usual tolerance of accuracy and roundness is less than .0001 and any deviation from this axis at the base of the needle, however slight, has a multiplied effect at its end. In fact no practical mechanical contraption has been found as yet to do this work with sufficient accuracy.



Drilling Machine

✦ ✦ ✦ ✦ ✦

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WHILE it is true that in the manufacturing of larger dies (above .010) it has been found possible to use interchangeable chuck carrying needles, this has never been conducive to the production of accurate work, and there is no question of using this method in the making of the finer dies.

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SOME of the important problems are thus the centering and grinding of the needle, shellacked in the chuck, as well as its periodical re-grinding to a more and more convenient shape, as the drilling progresses. It can readily be seen that little of this work can be mechanized and that accuracy and speed depend solely upon the craftsmanship of the workman, as well as upon his good and experienced judgment to successfully combine the frequency and the force of the peckering.

✦ ✦ ✦

One of the outstanding differences between fine die and large die drilling is that the latter are drilled through forceful hammering which speeds up the progress of the needle into the die. The needle in this case is thick enough to withstand pounding without being distorted or deflected. In the former case, however, the fineness of the needle precludes violent peckering and normal progress relies more on sheer abrasive wear.

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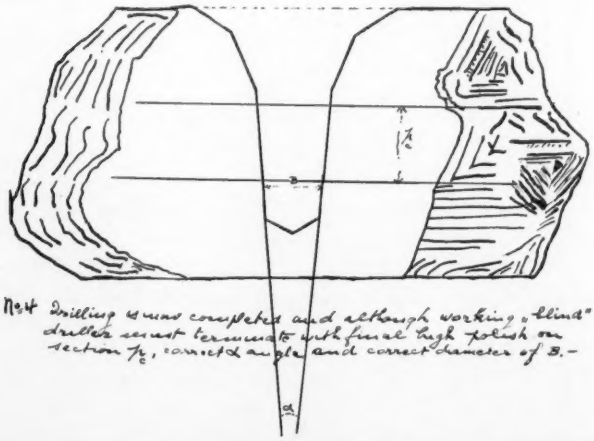
IN order to compensate this drawback and reach commercial speed of drilling the speed of


No. 4 Drilling is now completed and although working "blind" driller must terminate with final high polish on section ⅞, correct ∠ angle and correct diameter of B.-

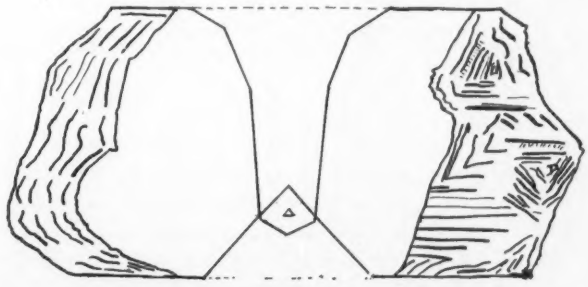


Fig. 5. Angle A is done by the "spotter" with a diamond splint. Also a "blind" operation spotter must carve this conical indentation in the exact axis of the drilling. Polishing will then round off all "shoulders" bringing die to desired size, polish and giving profile appropriate proportions as in Sketch No. 6.

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rotation of the needle is greatly increased. Machines must thus be more accurate and run without the slightest vibration for vibration will detract from the continuity of the contact between needle and die, and the drilling is likely to take twice or three times as long.

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It is obvious that fine die making requires greater technique and skill than large die making, and that there is a definite limit as to how far this work can be mechanized. A good large die maker is indeed a skilled laborer but a good fine die maker must be a craftsman.

✦ ✦ ✦

THE drilling is of course but one of the five or six operations that go into the manufacturing of a die. The others, such as countersinking or spotting, polishing and sizing, require equal skill and present different problems which all require craftsmanship. One can judge from this short expose that suitable labor cannot be found but must be trained. Also, that even after careful selection of the best fitted individuals it will take many years, or let us say many months so as to discourage no one, before one turns out a good mechanic.

✦ ✦ ✦

Capillary Dies

ALL the aforesaid applies to the difficult problem of getting production on dies ranging between .010 down to .002. But when it comes to the possibility of manufacturing dies below .002 I may as well say that there is no hope whatever of producing such dies in this country at short notice or at all under available conditions. Firstly, adequate machines for the making of capillary dies are not available in this country. Still, we may hope that the combined efforts of all die makers may cause them to acquire, or manufacture, machines of a lighter, faster and more accurate type than those they are actually using. The problem of training craftsmen seems to be the real stumbling block. The hope of selecting the best suited from among the men available to drill down from .010 below, finer and still finer until some may reach .002 can be fulfilled to a certain extent but not as easily as some people think. But the hope of successfully bringing these men to make sizes below .002 all the way down to .00039 is entirely illusory, for again in this case the manufacturing technique of the capillary die differs entirely from that of the fine die just as that of the large die differs from that of the fine die.

✦ ✦ ✦

The outstanding difference between capillary die drilling and fine die drilling is that the latter are drilled with a needle that still has a certain amount of rigidity so that it keeps straight when held horizontally and will withstand the peckering without being distorted or deflected, while in the latter case the needle is so fine that it bends by its own gravity when held horizontally and offers no resistance to the hammering.

✦ ✦ ✦

THIS is easily understandable when one thinks of the diameter of this needle. For instance, to drill a hole, .0008 one has to use a needle which is still much thinner at the end, but even .0008 is barely one-third as thick as a fine human hair. This again compels a complete change in the technique of the drilling. The needle is held horizontally parallel to the axis of the drilling by virtue of centrifugal speed. In order to obtain this result the rotary speed of the chuck must again be increased. We are now compelled to use a faster and yet more delicate and accurate machine that will stand the higher speed without overheating, vibrating or "play" between the bearings and the spindle. This is so much the more important that still greater accuracy is required from capillary dies.

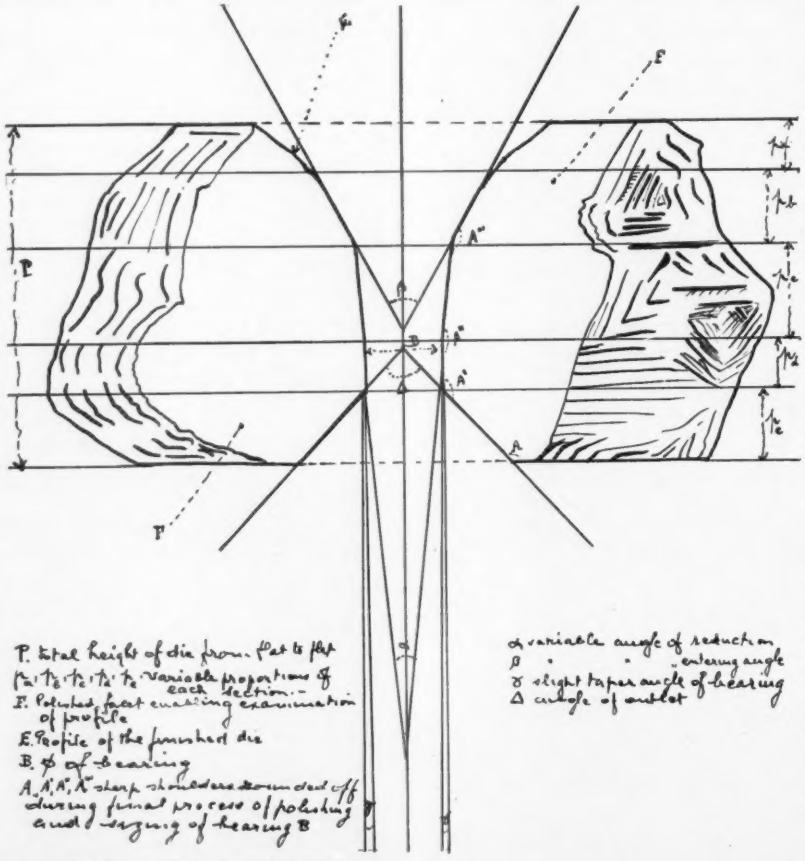
P. total height of die from flat to flat
t1 t2 t3 t4 t5 variable proportions of each section.
F. Polished flat enabling examination of profile
E. Profile of the finished die
B. ϕ of bearing
A, A', A'' sharp shoulders rounded off during final process of polishing and sizing of bearing B
α variable angle of reduction
β " " entering angle
γ slight taper angle of bearing
Δ outlet of outlet

Fig. 6. Finished die ready for setting in casing.

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WHILE fine dies are often made to suit requirements of tolerance reaching to as much as .0001, it goes without saying that in the case of capillary dies the tolerance is reduced to

(Please turn to Page 247)

STATISTICS --- JANUARY, 1941

PRODUCTION FOR SALE OF IRON AND STEEL PRODUCTS

AMERICAN IRON AND STEEL INSTITUTE
Capacity and Production for Sale of Iron and Steel Products

January - 1941
PERIOD

		Number of companies	Items	* Annual Capacity Net tons	Production for Sale—Net Tons: Current Month: Total	Current Month: Per cent of capacity	Current Month: Shipments: Export	Current Month: Shipments: To members of the industry for conversion into further finished products	Year to Date: Total	Year to Date: Per Cent of capacity	Year to Date: Shipments: Export	Year to Date: Shipments: To members of the industry for conversion into further finished products
Steel Products	Ingots, blooms, billets, slabs, sheet bars, etc.	31	1	xxxxxxx	577,451	xxx	220,953	127,415		xxx		
	Heavy structural shapes	8	2	5,175,800	362,829	82.5	25,755	xxxxxxx				xxxxxxx
	Steel piling	4	3	360,000	22,053	72.1	1,197	xxxxxxx				xxxxxxx
	Plates—Sheared and Universal	20	4	6,179,470	433,707	82.6	44,623	2,452				
	Skelp	7	5	xxxxxxx	79,155	xxx	7,877	38,642		xxx		
	Rails—Standard (over 60 lbs.)	4	6	3,613,600	135,950	44.3	12,554	xxxxxxx				xxxxxxx
	Light (60 lbs. and under)	6	7	302,800	17,633	68.5	6,726	xxxxxxx				xxxxxxx
	All other (Incl. girder, guard, etc.)	2	8	102,000	2,457	28.4	158	xxxxxxx				xxxxxxx
	Splice bar and tie plates	15	9	1,300,200	49,783	45.1	2,950	xxxxxxx				xxxxxxx
	Bars—Merchant	35	10	xxxxxxx	577,056	xxx	64,109	58,135		xxx		
	Concrete reinforcing—New billet	15	11	xxxxxxx	108,605	xxx	19,782	xxxxxxx		xxx		xxxxxxx
	Rerolling	17	12	xxxxxxx	9,060	xxx	674	xxxxxxx		xxx		xxxxxxx
	Cold finished—Carbon	18	13	xxxxxxx	93,381	xxx	1,845	xxxxxxx		xxx		xxxxxxx
	Alloy—Hot rolled	15	14	xxxxxxx	128,022	xxx	15,991	11,781		xxx		
	Cold finished	15	15	xxxxxxx	12,532	xxx	1,496	xxxxxxx		xxx		xxxxxxx
	Hoops and baling bands	5	16	xxxxxxx	7,040	xxx	133	xxxxxxx		xxx		xxxxxxx
	TOTAL BARS	53	17	12,675,585	935,696	86.9	104,030	69,916				
	Tool steel bars (rolled and forged)	15	18	127,870	8,092	74.5	889	xxxxxxx				xxxxxxx
	Pipe and tube—B. W.	13	19	2,013,200	133,387	78.0	4,183	xxxxxxx				xxxxxxx
	L. W.	9	20	1,128,260	40,450	42.2	1,422	xxxxxxx				xxxxxxx
	Electric weld	5	21	692,520	24,597	41.8	312	xxxxxxx				xxxxxxx
	Seamless	14	22	3,144,190	159,403	59.7	7,840	xxxxxxx				xxxxxxx
	Conduit	6	23	152,145	11,240	87.0	51	xxxxxxx				xxxxxxx
	Mechanical Tubing	13	24	513,975	39,501	90.5	3,889	xxxxxxx				xxxxxxx
	Wire rods	18	25	xxxxxxx	130,283	xxx	16,707	23,122		xxx		
	Wire—Drawn	36	26	2,299,340	178,949	91.6	12,407	1,948				
	Nails and staples	19	27	1,137,090	70,073	72.5	3,786	xxxxxxx				xxxxxxx
	Barbed and twisted	16	28	448,770	23,403	61.4	3,932	xxxxxxx				xxxxxxx
	Woven wire fence	15	29	786,790	26,577	39.8	519	xxxxxxx				xxxxxxx
	Bale ties	11	30	124,450	4,187	39.6	30	xxxxxxx				xxxxxxx
	All other wire products	5	31	27,030	488	21.3	-	xxxxxxx				xxxxxxx
	Fence posts	14	32	145,645	6,308	51.0	95	xxxxxxx				xxxxxxx
	Black plate	11	33	560,455	25,815	54.2	896	1				
	Tin plate—Hot rolled	7	34	866,120	20,729	28.2	394	xxxxxxx				xxxxxxx
	Cold reduced	10	35	2,995,300	188,438	74.0	16,393	xxxxxxx				xxxxxxx
	Sheets—Hot rolled	24	36	xxxxxxx	624,785	xxx	30,686	14,854		xxx		
	Galvanized	14	37	xxxxxxx	153,488	xxx	9,926	xxxxxxx		xxx		xxxxxxx
	Cold rolled	16	38	xxxxxxx	272,779	xxx	6,900	xxxxxxx		xxx		xxxxxxx
	All other	14	39	xxxxxxx	85,736	xxx	1,776	xxxxxxx		xxx		xxxxxxx
	TOTAL SHEETS	27	40	13,248,970	1,136,788	101.0	49,288	14,854				
	Strip—Hot rolled	24	41	3,522,480	175,612	58.7	6,823	22,193				
	Cold rolled	35	42	1,361,560	94,663	81.8	1,051	xxxxxxx				xxxxxxx
	Wheels (car, rolled steel)	5	43	422,825	19,812	55.2	134	xxxxxxx				xxxxxxx
	Axles	4	44	472,280	14,717	36.7	8	xxxxxxx				xxxxxxx
	Track spikes	11	45	327,275	12,635	45.4	314	xxxxxxx				xxxxxxx
	All other	3	46	9,100	1,051	136.0	12	xxxxxxx				xxxxxxx
	TOTAL STEEL PRODUCTS	132	47	xxxxxxx	5,163,912	xxx	558,198	300,543		xxx		
	Pig iron, ferro manganese and spiegel	24	48	xxxxxxx	663,668	xxx	46,327	210,768		xxx		
	Ingot moulds	4	49	xxxxxxx	58,707	xxx	28	xxxxxxx		xxx		xxxxxxx
Iron Products	Bars	8	50	118,395	4,320	42.9	1	249				
	Pipe and tubes	3	51	109,300	5,025	54.1	56	xxxxxxx				xxxxxxx
	All other	3	52	71,000	2,592	43.0	603	461				
	TOTAL IRON PRODUCTS (ITEMS 50 to 52)	11	53	234,195	11,937	60.0	660	710				

* To be revised.

Total number of companies included - 150

The estimated yield of products for sale from total ingot capacity of companies included above is 71.2 *%*
of ingot capacity or 57,533,200 *net tons.*
Production for sale, less shipments to members of the industry for further conversion, related to the estimated yield is as follows:
Current month 4,863,369 *N. T.;* 99.5 *%*
Year to date _____ *N. T.;* _____ *%*

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The Annual Dues Are $10.00 — For detailed information address
RICHARD E. BROWN, Secretary
THE WIRE ASSOCIATION
300 Main Street, Stamford, Conn.

Exports and Imports of Wire

Exports of Iron and Steel Wire Products in Jan. 1941 and Jan. 1940
(In gross tons)

	JAN. 1941	DEC. 1940	JAN. 1940
Wire rods	10,855	15,786	9,295
Strip steel	18,142	16,050	18,271
Plain, black or galvanized iron or steel wire	6,107	13,601	9,746
Barbed wire and woven wire fencing	2,135	5,654	2,917
Woven wire cloth	270	388	182
Wire rope	1,642	1,153	809
Insulated iron or steel wire and cable—see analysis below			
Other wire and manufactures	1,135	1,278	1,226
Wire nails	1,787	2,347	5,358
Tacks	76	104	73
Other nails, including staples	217	610	329
Bolts, machine screws, nuts, rivets and washers	3,377	2,901	1,081
Total, these 11 classifications	45,743	59,872	49,287

Imports of Iron and Steel Wire Into the United States
(In gross tons)

Concrete reinforcement bars	.....	.....	.....
Hollow bar and drill steel	14	.....	189
Wire rods	.....	.....	1,037
Barbed wire	.....	.....	.....
Round iron and steel wire	3	.....	200
Telephone and telegraph wire	.....	.....	.....
Flat wire and strip steel	184	55	230
Wire rope and strand	34	6	81
Other wire	1	.....	.....
Hoops and bands	.....	5	305
Nails, tacks and staples	4	3	38
Bolts, nuts and rivets	2	1	5
Total, these 12 classifications	242	70	2,085

Exports of Insulated Wire and Cable, January, 1941

	Foreign		To U. S. Possessions	
	Pounds	Dollars	Pounds	Dollars
Rubber covered wire	1,888,945	$437,029	179,689	$ 38,457
Weatherproof wire	114,117	21,633	125,824	22,794
Other insulated copper wire	2,561,920	506,715	398,012	72,806
Total, these 3 classifications	4,564,982	$965,377	703,525	$134,057

Exports of Iron & Steel Products at Lowest Level Since June 1940

TOTALING 653,798 gross tons and valued at $39,691,003, exports of iron and steel products (scrap excepted) from the United States in January 1941 were at their lowest level for any month since June 1940. Exports in December 1940 aggregated 735,178 tons valued at $44,259,176 while those of January 1940 amounted to 396,064 tons valued at $31,153,365.

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REFLECTING application of the provisions of the export licensing program to the majority of the classes of iron and steel included in the above figures, exports to all Continental areas other than Europe were smaller in January than in December. The countries of North and Central America and the West Indies received 92,165 tons of American iron and steel against 108,639 tons in December; shipments to South America dropped to 24,907 from 66,163 tons; trade with the Far East amounted to 49,123 tons against 153,225 tons; while Africa received 25,466 tons against the 33,909-ton trade of the preceding month. Only Europe—462,137 against 373,242 tons—received more steel in January than in December.

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United Kingdom Continued Largest Market

THE United Kingdom continued to be the largest individual market for American iron and steel, taking 458,763 tons in January against 362,366 tons in December. Prominent items included in the January total were nonalloy steel ingots and blooms, 193,915 tons; pig iron, 76,834 tons; alloy steel ingots, and blooms, 53,033 tons; and 26,704 tons of nonalloy "other" plates. Second place went to Canada with takings totaling 69,197 tons including 16,881 tons of nonalloy black steel sheets, 9,914 tons of nonalloy "other" plates, and 7,492 tons of nonalloy steel ingots and blooms. Other leading markets in the January trade were the Union of South Africa, 17,739 tons; the Netherlands Indies, 11,149 tons; Brazil, 11,084 tons; and Iran, 11,081 tons.

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THE month's leading commodities in point of tonnages exported were nonalloy steel ingots and blooms, 201,883 tons; pig iron, 80,322 tons; alloy steel ingots and blooms, 55,191 tons; nonalloy "other" plates, 43,846 tons; plain structural shapes, 37,752 tons; and nonalloy black steel sheets 36,266 tons.

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January Scrap Exports Lower

EXPORTS of scrap from the United States declined in January to 45,055 gross tons valued at $902,535; shipments in December amounted to 69,980 tons valued at $1,293,579, while in January 1940, 187,457 tons of such materials valued at $3,567,221 were shipped to foreign consumers.

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INCLUDED in the 45,055-ton total for January was 43,467 tons of iron and steel scrap including 14,621 tons of No. 1 heavy melting scrap, 15,990 tons of No. 2 heavy melting scrap, 3,414 tons of baled and bundled scrap, 2,429 tons of cast and burnt scrap. January is the first month in which any distinction has been made in the grades of iron and steel scrap exported.

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THE rest of the January scrap trade included 746 tons of tin plate circles, and cobbles; 806 tons of waste-waste tin plate; and 36 tons of terne plate clippings.

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THE United Kingdom was the chief buyer of American scrap in January, its purchases totaling 38,776 tons. Other leading purchasers during the month were Canada, 2,888 tons; Mexico, 1,376 tons; and China, 1,346 tons.

The 1941 Annual Pittsburgh Regional Meeting

THE Annual Pittsburgh Regional Meeting of the Wire Association for 1941 will be held on Thursday, April 17th at 6:30 P. M., in the William Penn Hotel, Pittsburgh, Pa.

✦ ✦ ✦

THE technical sessions will convene at 8:30 P. M. and there will be papers and discussions on two subjects.

1. Government Inspection
2. Cold Heading Materials

✦ ✦ ✦

PRECEDING the technical meeting there will be a dinner in the William Penn Hotel at which the guest speaker will be **Lieut. Col. Scott B. Ritchie,** Ordnance Department, U. S. Army from the Watertown Arsenal, Watertown, Mass.

✦ ✦ ✦

COL. RITCHIE has been selected by the War Department as the man best qualified to present the subject of inspection of material for the Army, to the Wire Association and since at the present time the inspection of material for the Army, Navy and other Government agencies is very prevalent, his talk should be of great interest to the members of the Wire Association and guests. This dinner will convene at 6:30 P. M., promptly.

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THE speakers who will present "off-the-record" papers at the technical session following the dinner have been selected with a view to securing the best qualified men available at this time and following the success of last year's meeting at which everything was "off-the-record", this year's meeting conducted along similar lines with nothing appearing in print either before or after the meeting, should prove both as interesting and as successful as the meeting held last year.

THERE will be a registration fee of $2.50 for each person attending this meeting. This registration fee includes the dinner preceding the meeting. All wire mill men are invited to attend and an early reservation is suggested. Such reservations should be sent either to **Richard E. Brown,** Executive Secretary of the Wire Association, 300 Main Street, Stamford, Conn., or **Dr. S. A. Braley,** Ch. Met. Field Engineer, Pittsburgh Steel Company, Grant Building, Pittsburgh, Pa., who is Chairman of the Pittsburgh Regional Meeting.

✦ ✦ ✦

Upson-Walton to Move Wire Rope Plant to Cleveland

THE Upson-Walton Company of Cleveland has announced that the Belleville, New Jersey, wire rope manufacturing plant of their company will be moved to Cleveland in 1942. A new factory building will be erected to house this division of the company's business.

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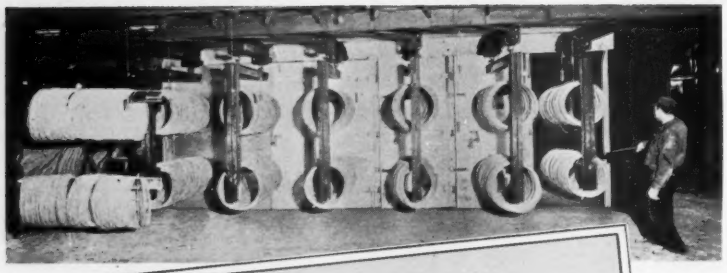

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Fine Die Policy Announced By Office of Production Management

(*Continued from Page 230*)

1940 to which eleven firms were invited to send representatives. The following facts were disclosed:

(a) We have an abundance of manufacturing facilities for the production of requirements of diamond dies from .004″ to the largest sizes.

(b) Several manufacturers will within the next few months be able to manufacture dies down to .002″.

(c) Only one small group (Mr. Brenon and the members of his immediate family, presently residing in New Jersey) are producing 25 dies from .00039″ to .002″ per week, each working over 80 hours per week. Taking into account the fact that Mr. Brenon has a long-experienced driller and, with the careful supervision of his family, will produce dies at a much faster rate than newly-trained personnel of the other diamond die manufacturers, the supplying of approximately 10,000 to 12,000 dies from .00039″ to .002″ will require at least eighty highly-trained operators, whose training would be a costly task, difficult to achieve.

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3. IN February, 1941, upon checking the progress made in the manufacture of fine diamond dies, we ascertained that the lack of progress in the drilling of these dies could be laid to the following factors:

(a) The uncertainty of a future market for fine dies should the relationship with France be re-established.

(b) The large volume of orders, for months in advance, for large sizes of dies, in which the manufacturers have experienced and are assured of definite profits.

(c) Reluctance to train new personnel for fear that such new employees, upon whom considerable effort and money would be expended, might go to competitors after the period of training.

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4. TO overcome the immediate shortage of fine dies, arrangements were made by this office, in collaboration with the British authorities, to make quantities of fine dies available to the American wire drawers. As a result, over 2,000 fine dies have been delivered to the Defense Supplies Corporation, most of which have already been allocated to various wire drawing firms at prices quoted in January by the importers.

(*Continued on Page 246*)

Wire-Making Experiments With Sintered Copper

(*Continued from Page 222*)

granular structures than the fine powders; but the differences are not striking.

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INCLUSIONS of impurities, identified chiefly as cuprous oxide and silica, were found in every specimen. The wires from powder A contain fewer impurities than the others, and the maximum is found in samples made from powder R. These inclusions occur as single globules and crystals, or in strings parallel to the axis of the wire.

✦ ✦ ✦

References

1) **C. G. Goetzel: "The Influence of Processing Methods on the Structure and Properties of Compressed and Heat-Treated Copper Powders," Faculty of Pure Science, Columbia University, 1939.**
2) **C. G. Goetzel: "Powder Metallurgy of Copper," Metals & Alloys, July and August, 1940.**
3) **C. G. Goetzel: "Structure and Properties of Copper Powder Compacts," Journal British Institute of Metals, Vol. 66, part 9, p. 319-329, (1940).**
4) **C. G. Goetzel: "Some Properties of Oxygen-Free High Conductivity Copper" (OFHC), Transactions, American Society for Metals, 1939.**
5) **American Society for Testing Materials: "Standard Designations," B 1-27, B 3-27.**
6) **J. N. Kenyon: "The Rotating Wire Arc Fatigue Machine for Testing of Small Diameter Wire," Transactions, A.S.T.M., p. 156, (1935).**

✦ ✦ ✦

PART II

Electrical Conductivity will be published in the May, 1941 issue of Wire and Wire Products.

George B. Proud, Treasurer, Western Electric Company

GEORGE B. PROUD, assistant treasurer, was elected treasurer by the directors to succeed Mr. Frederic H. Leggett, who retired in accordance with Bell System practice.

✦ ✦ ✦

MR. PROUD joined Western Electric in 1909 as an accountant, serving as an auditor at the Company's principal manufacturing plant in Chicago and then at New York headquarters. Later he was made general auditor.

✦ ✦ ✦

IN 1924 he was elected assistant treasurer, and four years later was appointed assistant comptroller of the Company, and was again elected assistant treasurer on February 1, 1941.

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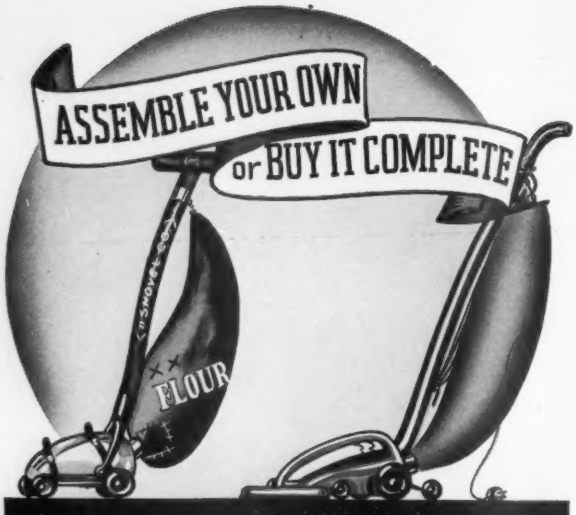

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Diamond Wire Drawing Dies in Defense

IN a recent notice issued by **E. R. Stettinius, Jr.**, Director of Priorities for the Office of Production Management, it was announced that the allocation of diamond wire drawing dies for defense industries would be put before the Metal and Minerals Section of the Priorities Division of the Office of Production Management for decision and that the recommendations adopted would then be turned over to the Defense Supplies Corporation which would handle all applications and the actual distribution of diamond wire drawing dies.

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THE necessity for this does not seem to be apparent at the present time as there is not only an entirely adequate supply of diamond wire drawing dies for all normal purposes but there is a sufficient productive capacity within the industry to take care of any abnormal requirement which may arise in connection with the national defense effort.

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ABOUT the only thing which might be accomplished by turning over control of the diamond wire drawing die industry to the Office of Production Management would be to increase the price of the dies as a result of Government control.

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THE question of fine die manufacture, i.e., dies .002″ or smaller, may present some difficulty but nothing of sufficiently great importance to warrant the exercise of control over the whole industry.

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AT the present time it is estimated by leading diamond die manufacturers that about 2,000 dies finer than .002″ are required to meet all the regular demands of industry. Leading suppliers estimate that operating at maximum defense capacity the greatest demand would not exceed 4,000 dies per year in these sizes, unless some new uses develop, since, at the present time, about 1,250 dies per year are produced by from three to four people and approximately 24

machines, it would seem that the training of a dozen die makers and the installation of from 75 to 100 machines would, to begin with, be all that would be required to solve any shortage now arising.

✦ ✦ ✦

THERE was a statement made to the trade that the Defense Supplies Corporation had funds available for the purchase of several thousand dies in small sizes but so far as we are able to ascertain these dies are not actually on hand (except for a few hundred already bought and partly distributed to the trade) but are expected to be secured through a division of the British Purchasing Commission in the United States.

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BECAUSE of control exercised over the release of diamonds there will undoubtedly be difficulties and delays in securing any additional supplies of finished dies in these fine sizes from abroad and consequently it would seem to be much better for three or four of the leading manufacturers or producers of finished diamond wire drawing dies in the United States to each undertake the training of a few good men from among their present experienced die makers to become finishers of these fine dies.

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THE situation is not so serious and does not seem to offer serious enough possibilities as to prevent ordinary business competition taking its course, particularly as prices are now reasonably low to the consumer.

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ANOTHER consideration would be that should the mills be compelled to buy diamond wire drawing dies through a Government agency, such as the Defense Supplies Corporation, which is a subsidiary of the Reconstruction Finance Corporation, the buyer would have to take his dies without a guarantee as to size or quality of the stones and would also have to make payment in advance. Some argument has been presented for the establishment of a fine die industry in the United States since some large proportion of these fine dies have heretofore been imported from Europe. On the face of it there doesn't seem to be any reason to establish such an industry as the requirements can be taken care of by the existing die manufacturers in their stride. Further, how about after the war? European dies would then come in at lower rates than ever before, the duty would have to be terrific and the ultimate consumer would once more have it "hung on his eye." The evidence would seem to indicate that there was no necessity for Government control or intervention in the production of fine diamond wire drawing dies other than calling the attention of the die manufacturer to the fact that a temporary yearly shortage might exist for from 1,000 to 3,000 of these dies for the duration of the emergency. With this knowledge the manufacturers will have no difficulty in training a sufficient number of people to handle the problem readily, and this can be done as the necessary machines are available at this time.

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A Review of Recent Wire Patents

No. 2,230,670, APPARATUS FOR COILING STRIP, patented February 4, 1941 by Maurice P. Sieger, Pittsburgh, Pa., assignor to United Engineering and Foundry Company, Pittsburgh, Pa., a corporation of Pennsylvania.

This is a feeding apparatus for metal having a tendency to buckle, and comprises a pair of pinch rolls for feeding said blanks between them, and a constant pressure means for biasing to a limited extent one roll toward the other, said biasing means being adapted to permit one roll to be forced away from the other by folds in said blanks whereby said folds pass between the rolls.

✦ ✦ ✦

No. 2,230,887, ELECTRIC CABLE, patented February 4, 1941 by William F. Lamela, East Paterson, N. J., assignor to The Okonite Company, Passaic, N. J., a corporation of New Jersey.

Each wire conductor is surrounded with layers of asbestos rovings and an intermediate glass wool layer, said layers being saturated with a non-conductive, water insoluble flameproof compound incapable of being decomposed to a conducting medium.

✦ ✦ ✦

No. 2,230,888, ELECTRIC CABLE, patented February 4, 1941 by William F. Lamela, East Paterson, N. J., assignor to The Okonite Company, Passaic, N. J., a corporation of New Jersey.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

This is a variation of the assembly disclosed in the above-named Patent No. 2,230,887.

✦ ✦ ✦

No. 2,231,165, METHOD AND MACHINE FOR APPLYING PROTECTIVE CAPS TO NAILHEADS, patented February 11, 1941 by Harry King and William M. Bell, Portsmouth, Ohio, assignors to Wheeling Steel Corporation, Wheeling, W. Va., a corporation of Delaware.

A turntable is provided, having a number of molds, spaced circumferentially thereof adapted to receive nailheads, the molds and table having holes therethrough for nail shanks, means for partly lifting nails from the holes after formation of a cap thereon and means below the surface of the table engaging the nail shanks for frictionally holding the partially lifted nails in elevated position.

✦ ✦ ✦

No. 2,231,606, ELECTRICAL CABLE, patented February 11, 1941 by Howard J. Stewart, York, Pa., assignor to General Electric Company, a corporation of New York.

It is claimed that this cable maintains its good dielectric strength at elevated temperatures and in the presence of moisture, for a prolonged period.

✦ ✦ ✦

No. 2,231,712, COUPLED FLAT WIRE, patented February 11, 1941 by William W. Gleason, Chicago, Ill., assignor to Nachman Springfilled Corporation, Chicago, Ill., a corporation of Illinois.

This device is adapted to maintain overlapped portions of flat wire against relative movement.

✦ ✦ ✦

No. 2,231,910, CABLE-MAKING APPARATUS, patented February 18, 1941 by George E. Henning, Joppa, Md., and Fred V. Johnson, deceased, late of Baltimore, Md., by Lila T. Johnson, executrix, Baltimore, Md., and Sigurd Thronsen, Baltimore, Md., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

The assembly comprises a spacer-carrying chain having spacer-receiving pockers therein for receiving slotted spacers, means for driving the chain, means operable in timed relation to the operation of the chain for feeding a spacer into each of the pockers, and means for forcing wires into the slots in the spacers.

✦ ✦ ✦

No. 2,232,072, THE WIRE FOR SPRING ASSEMBLY AND METHOD OF MAKING SAME, patented February

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

HIGH SPEED TUBULAR STRANDING HEADS — TYPE "TH"

SIX SECOND STOPS

HEAVY BOX BASE

DOUBLE LATCHED STEEL BOAT CRADLES

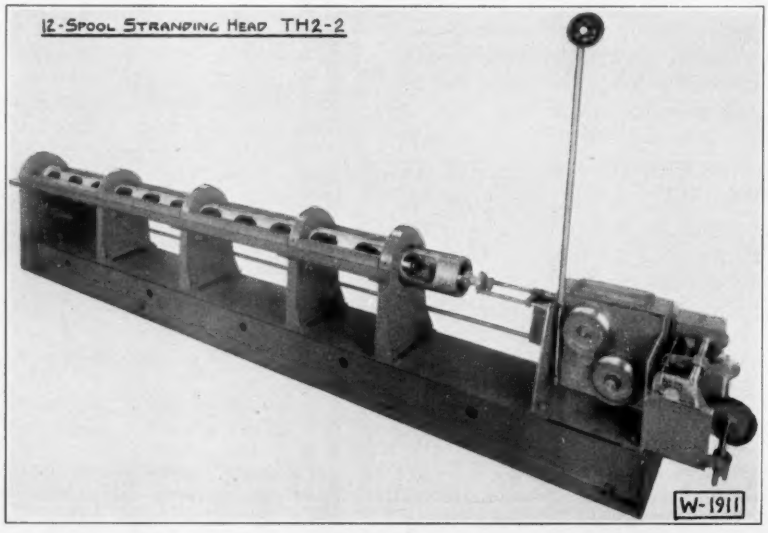
STEEL SPIDERS

ALL BALL BEARING

TUNGSTEN CARBIDE GUIDES

LOW WIRE ANGLES

DOUBLE GROOVED CAPSTANS



3" 4½" 8" 10" 12" 16" 22" 24" & 30" SPOOL SIZES

18, 1941 by David I. Levine, Lynn, Mass., assignor to Lisson-Melen Co., Lynn, Mass., a corporation of Massachusetts.

Eight-configured loops are provided, each proturding in its entirety on one side of the tie wire at spaced regions thereof, the S-configuration of said loops being substantially perpendicular with relation to the directionality of the tie wire.

✦ ✦ ✦

No. 2,232,085, INSULATED ELECTRIC CONDUCTOR, patented February 18, 1941 by Ernest R. Troche, Towson, Md., assignor to Western Electric Company, Incorporated, New York, a corporation of New York.

A duplex or multiple conductor is disclosed, having a joining portion, restricted in size, joining the insulation of the conductors, this portion also being of insulation.

✦ ✦ ✦

No. 2,232,336, FASTENING SCREW, patented February 18, 1941 by Johann Meersteiner, West New York, N. J., Frieda Meersteiner administratrix of said Johann Meersteiner, deceased.

The screw is of the self-cutting threads type, adapted to be inserted in a perforation in a metal body, the shank being rolled to form both threads and grooves worked into the shank with intervening thread segments, said grooves extending from end to end of the threaded portion and providing space for the ready disposal of waste, the thread segments having abrupt thread-cutting leading ends.

✦ ✦ ✦

No. 2,232,337, METAL FASTENING SCREW, ROLLING APPARATUS AND METHOD, patented February 18, 1941 by Johann Meersteiner, West New York, N. J.; Frieda Meersteiner administratix of said Johann Meersteiner, deceased.

This patent covers the machine for rolling the screw disclosed in Patent No. 2,232,336.

✦ ✦ ✦

No. 2,232,846, IDENTIFYING STRIP FOR USE IN CONNECTION WITH INSULATED ELECTRICAL CONDUCTORS, patented February 25, 1941 by Eli Freydberg, New York, N. Y., assignor to Freydberg Bros., Inc., New York, N. Y., a corporation of New York.

About the wire conductor, is an outer covering entirely impregnated with a saturant, and an identification strip positioned intermediate the outer covering and the metallic core and comprising a printed sheet of regenerated cellulose, and with a coating on its outer surface of ethyl cellulose of such thickness as to protect said regenerated cellulose from deterioration at temperatures of approximately 300°F.

✦ ✦ ✦

No. 2,232,993, WIRE DRAWING MACHINE, patented February 25, 1941 by Leonard G. Berquist, Niles, Mich., assignor to National Standard Company, Niles, Mich., a corporation of Michigan.

A uniform back-tensioning device is provided ,the position of which is varied by variations in the feeding of the wire through the die, the device being controlled through a number of mercury switches.

✦ ✦ ✦

No. 2,233,106, CABLE SHEATHING MACHINE, patented February 25, 1941 by Lee Roy McGuire, Jackson Heights, N. Y., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

About the cable-receiving mandrel is a space, through which a molten sheathing material may be progressively moved and cooled and solidified by contact with the mandrel and cylinder surfaces prior to ejection from the space in combination with an annular piston contained in the space and reciprocable therein to advance the material therethrough.

✦ ✦ ✦

Rubber-Covered Wire Exports

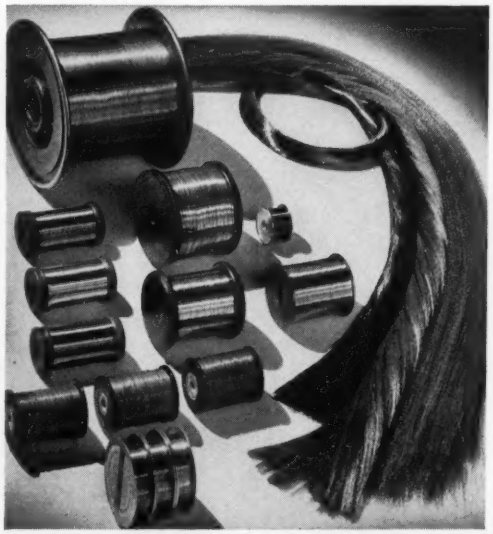
IN January, 1941, rubber-covered wire exported to world markets amounted to $437,029, compared with $194,971 in the preceding month, an increase of 124.1 percent. Other insulated copper wire shipments were valued at $506,715, an increase of 43 percent from the December total of $354,431.

This is an invitation for you to become a member of The Wire Association.

The Annual Dues are $10.00

WHAT'S FACE POWDER GOT TO DO WITH WIRE?

Quite a lot, we think — for screens made of Callite fine wire are used in the sifting of milady's face powder. Handling such fine material is an exacting job, but it's just one of the many applications of Callite wire where there can be no compromise with quality. If wire quality and dependability mean the difference between profit and loss in your business, specify Callite—obtainable in a wide variety of shapes, sizes, metals, and alloys. Investigate today.



Write for

COMPLETE DETAILS

Callite wires are available in aluminum, steel, stainless steel, Everdur, brass—all grades, brush wire, commercial bronze, nickel-silver alloys and in combinations of these and other alloys. In round, flat and special shapes in sizes down to .002".

CALLITE WIRES

CALLITE TUNGSTEN CORPORATION

572-39th STREET · UNION CITY, NEW JERSEY

Branch Offices: Chicago, Ill. · Cleveland, O.

A WIRE FOR EVERY NEED — CALLITE TUNGSTEN CORPORATION — CT

High Speed Steel Production

THE rate at which new plants using machine tools go into operation will be the big factor in determining whether high speed steel production is ample to meet all normal and emergency needs, it was pointed out today by L. Gerald Firth, president, Firth-Sterling Steel Company. "The pressure of demand for high speed steel should ease off when the nation has passed the crest in the opening of new factories," Mr. Firth said.

✦ ✦ ✦

"THE original tooling requirements of a new plant are, in the usual instance, greatly in excess of its monthly tool consumption. It is pretty much like a couple setting up housekeeping: once their furnishings and supplies are installed, their replacement needs are nominal. A new machining plant may need as much as 10 tons of tool steel to provide for all layouts and set up for initial operation; thereafter, replacement of consumed tools may be at the rate of less than a ton per month."

THE extent to which this initial tooling up has affected purchases of high speed steel is indicated, Mr. Firth explained, by a comparison with 1929, the previous peak period for tool steel production. "High speed steel production during 1929 was in the neighborhood of 14,000 tons, whereas the present demand is at an apparent yearly rate of more than 20,000 tons. This increase is all the more significant when we remember that improvements in tools and tooling since 1929 have resulted in a great deal more production per tool. And it must be considered also that a great many machining jobs have been taken over by the sintered carbides.

✦ ✦ ✦

"IT is difficult to explain this increase in demand unless we attribute it to the rapid construction of new plants. The rate at which such extraordinary construction continues will largely determine the intensity of pressure on tool steel production facilities. Meanwhile, producers and users can guard against creation of artificial pressure by keeping purchases as nearly as possible in line with consumption, thus avoiding building up excess stocks."

✦ ✦ ✦

Domestic Lamp Tungsten to Supplant Foreign Supplies

SINCE war abroad may cut off foreign sources of high-grade tungsten ore used in the preparation of incandescent lamp filaments, manufacturing and laboratory experiments in the Westinghouse Lamp Division research laboratories are now being speeded to test domestic and South American ores.

✦ ✦ ✦

TUNGSTEN, considered one of the nation's strategic metals, is widely used in the steel industry in making machine tools and alloys important in the manufacture of motor parts, as well as in making electric lamps. Analyses of samples of domestic ores by W. C. Lilliendahl of Westinghouse show that wolframite from the state of Washington, South Dakota, Idaho, Arizona and other localities may yield satisfactory tungsten.

Syncro announces . . . . .

a new screen wire drawing machine

The new Syncro type B.C.-14 machine for drawing copper, bronze, or brass screen wire produces a maximum coil of 30 lbs. at a nominal finishing speed of 2500 F.P.M. . . . An adjustable package switch is provided . . . This machine is equipped with Syncro type replaceable steel draw block tires . . . The coiler produces either right or left hand coils . . . The finish die holder is adjustable and all die holders are continuously flushed with solution . . . The machine can be furnished with 8 - 10 - 12 or 14 dies . . . The change gears for obtaining split B & S gauges of wire are readily accessible . . . The motor base is adjustable so proper driving belt tension is easily maintained.

If desired, the B.C.-14 machine can be furnished as a spooler type machine to produce wire at 4000 F.P.M.

Write for complete details.

SYNCRO • MACHINE • COMPANY

420 Lexington Ave., New York — McCormick Bldg., Chicago

Represented in Canada By—Canadian Elevator Equipment Co., Ltd., Toronto

IN the lamp industry the purest ore on the market has always been used because the tungsten in lamp filaments must be more than 99.9 per cent pure. For many years, Chinese or Australian tungsten ore has proved best for the purpose.

✦ ✦ ✦

SINCE the war began Australian wolframite has been shipped to England, and little of it has been available in this country. Likewise the war in China has effectively bottled up Chinese ore which only a few years ago flooded the market.

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TUNGSTEN ores from Argentina, in addition to domestic ores, are being tried. These compare favorably with Australian, and several tons are now being used on an experimental basis in lamp manufacturing.

✦ ✦ ✦

IN recovering tungsten from wolframite, it is necessary to eliminate impurities from the ore and extract tungstic oxide, a compound of tungsten that is bright yellow, looks like powdered sulphur, and can be transformed readily into gray metallic tungsten powder. Average yield of tungstic oxide from various domestic ores was found to be roughly 95 per cent, based upon the oxide content of the ore.

✦ ✦ ✦

SHOULD it become necessary to use domestic or South American ore, refining processes would not have to be changed fundamentally. The presence of more impurities, however, may make it more difficult to produce pure tungsten. In the production of tungsten for lamp filaments, great care and accuracy must be exercised. The high melting point of the metal — about 6080 degrees Fahrenheit (3360° C.) or more than half the surface temperature of the sum—prohibits melting it in crucibles, because there is no crucible material having a higher melting point.

TUNGSTEN used for such fine work must be extremely uniform in quality. Only about 6 per cent of all tungsten on the market during a year's time is purchased for lamp manufacturing. During the 2-year period 1938-1939 a total of 824 tons of tungsten ore was imported in this country, as compared with 1883 tons in 1936, and 2848 in 1937. In 1939 the United States produced 3603 tons of ore, very little of which found its way into incandescent lamps.

R. E. Christie, Vice President Crucible Steel Company

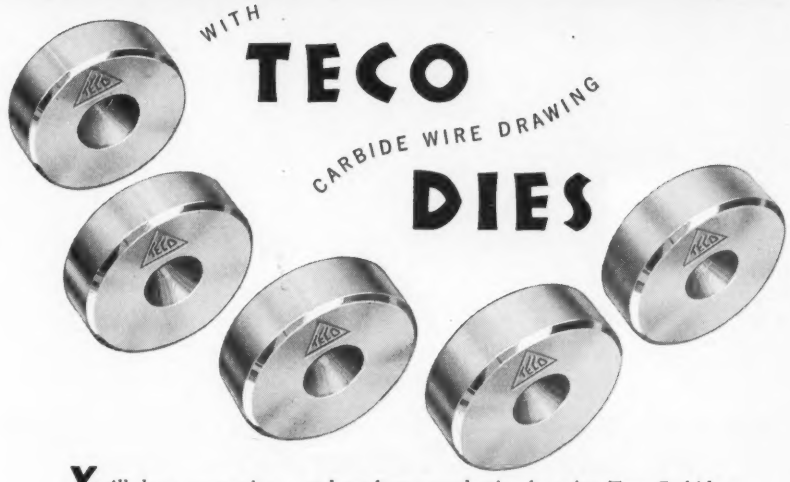
THE appointment of **Raymond E. Christie**, a prominent figure in the stainless and specialty steel industry, as vice president and director of the Crucible Steel Company of America, at New York City, was recently announced.

✦ ✦ ✦

MR. CHRISTIE was formerly assistant to the president and has had a long and varied experience with the Crucible organization in both branch and executive office posts.

DEFENSE INDUSTRIES REPORT MORE WIRE TONNAGE PER DIE

WITH **TECO** CARBIDE WIRE DRAWING **DIES**



You'll draw more wire . . . and get better production by using Teco Carbide Dies for the wire drawing job. This is cold, hard fact . . . demonstrated month after month in plants on national defense production.

Teco Dies increase wire tonnage through their dependable, long-life performance. Interruptions are fewer, wire rejections reduced to an absolute minimum. For Teco Dies are nearly diamond hard, and that means slow to wear. Scratched and out-of-round wire can be drawn smooth without endangering the die, or halting production.

If you want more wire tonnage, and finer quality wire — investigate Teco Carbide wire drawing dies. A Tungsten Electric engineer will be glad to discuss your wire drawing problems with you. Consult us today. Get the complete, cost-cutting story.

Pioneers in Tungsten Carbide for over a Quarter of a Century

NEVER SAY DIE . . . *always specify*
TECO CARBIDE DIES
for smooth wire drawing . . . THEY LAST LONGER

Tungsten Electric supplies carbide blanks, tools, bits. Wire and bar dies, tubing, extruding and sizing dies. Also, special tools, such as spot facers, reamers, broaches, form tools, etc.

TUNGSTEN ELECTRIC CORPORATION
564 - 39th ST. • UNION CITY, N. J.
Branch Office: 2900 Euclid Ave., Cleveland, O.

Fine Die Policy Announced By Office of Production Management

(*Continued from Page 238*)

5. THE Defense Supplies Corporation is endeavoring to make available to the American wire drawers fine dies between .00039" and .002" until such time as the American diamond die manufacturers are able to meet such demand.

6. EARLY this month, this office, in collaboration with the Defense Supplies Corporation, met with the five largest users of fine diamond dies below .001", and it was the unanimous expression of these firms that they prefer that the Defense Supplies Corporation handle their diamond die requirements from .00039" to .005", and that the corporation make its own arrangements with the diamond die manufacturers for the production of these requirements. It was their opinion that only in this manner could they hope for speedy establishment of such production. A subsequent meeting with the diamond die manufacturers followed, and their undivided opinion was identical with that of the wire drawers.

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7. IT is contemplated, therefore, that the Defense Supplies Corporation will handle the requirements of fine dies from .00039" to .005" for those wire drawing firms which are drawing wire below .001" and which will enter into a definite contract with the corporation for the purchase of such dies. You will see, therefore, that the American wire drawing concerns are free to exercise their own choice as to the source of their diamond die purchases. The diamond die manufacturers are similarly free to choose their own customers.

✦ ✦ ✦

INQUIRIES forwarded to eighteen firms engaged in the manufacture of diamond dies were made to ascertain their attitude as to the commencement of production on a guaranteed basis of continuity of production. We believe that only five of these will choose to accept such an arrangement. However, we expect definite commitments by the middle of next week."

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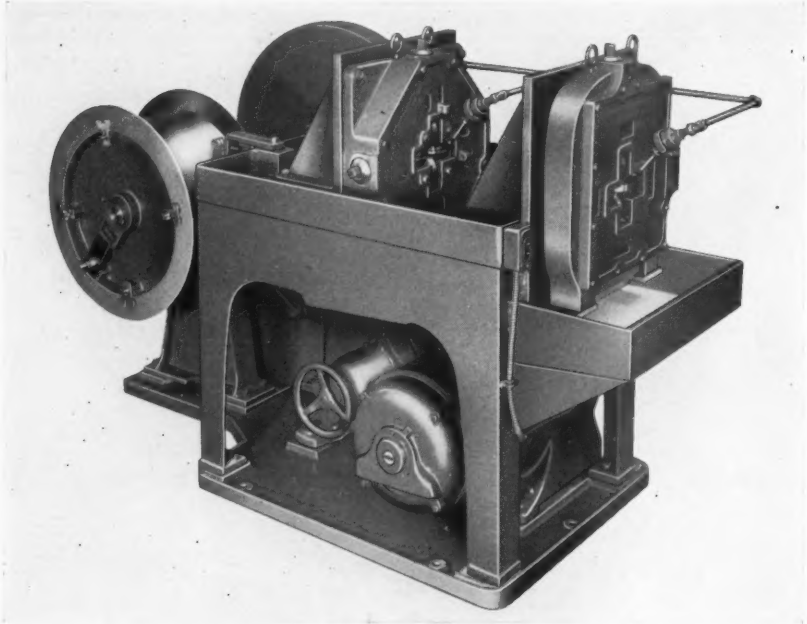
THIS information definitely clarifies the situation as the O.P.M. bases its estimates upon the results of actual investigation of requirements of the mills drawing these fine sizes of wire.



Low cost production in forming wire shapes with Standard Tandem Turks Heads

Photograph shows a tandem mounting of a No. 4 adjustable draw plate (Turks Head). This unit is equipped with a circulating coolant system, with a variable speed motor drive and a takeup drum of the shedding type. Stands equipped with coolant circulating system are available for all sizes.

This tandem unit will reduce .300" round steel rod to approximately 3/16" square in one pass, at an average production rate of 140' per minute. Capacities from ½" round on the No. 5 Turks Head to .020' on the No. 2.

These Turks Heads can be either Universal or Plain types to produce rectangular, square, keystone, and irregular shapes.

In addition to the type shown above there are available other types arranged for location on bull blocks and draw benches.

Let us discuss possible applications of this machine to your work—address

★

Ask for catalogs showing Standard Swagers, Presses, Draw Benches, Rolling Mills, also.

IT'S **STANDARD** PRACTICE

MACHINERY COMPANY

PROVIDENCE, RHODE ISLAND

This is an invitation for you to become a member of The Wire Association. ✦ ✦ ✦ ✦ ✦ ✦

The Annual Dues are $10.00

Survey of the Fine Die Problem

(*Continued from Page 234*)

.00001. Here is another difficulty: The diamond is usually shellacked to the end of the holder and centered before the shellac cools off with the very drilling needle already mounted in the chuck. This can of course not be done when the needle is so fine as to sway at the mere blow of the breath, and thus centering of the die in this way is abandoned, and is replaced by a still more delicate method.

✦ ✦ ✦

IT seems needless to point out that this kind of work requires a long apprenticeship, consummate skill and of course special aptitude. I have given but a rough outline of the work, but it can be said that it is made up of hundreds of small tricks which can, of course, be taught but which take a long time to acquire. I will add that a technology for this work in printed form is not available anywhere and that there are probably very few individuals in this country who have had experience with it.

✦ ✦ ✦

IN resumé, if wire drawers are to entertain any hope of obtaining adequate supplies of fine dies there seems to be no other alternative but to start doing something about it "now." We may find that it will take a discouraging amount of time to arrive at a consistent production of fine and capillary dies, but the longer one postpones the very first steps the worse it will be. Immediate action should be taken about manufacturing the machines required and simultaneously some decision should be arrived at as to how, by whom, and where suitable young men can be found and trained.

Come to the Pittsburgh Regional Meeting, William Penn Hotel, Pittsburgh, Pa., April 17, 1941.

Guy W. Vaughn Elected Director Of Western Electric Company

GUY W. VAUGHAN, president of the Curtiss Wright Corporation and its subsidiary, Wright Aeronautical Corporation, was elected a director of Western Electric Company at a regular meeting of that Company's board of directors.

✦ ✦ ✦

HE entered aviation in 1917 as quality engineer of the Wright-Martin Company. In 1924 Mr. Vaughan became factory manager of the Wright Aeronautical Corporation and the next year was made vice president and general manager. During this period he supervised development of the Wright Whirlwind engine, first of the now popular air-cooled radial types.

✦ ✦ ✦

HE was elected president of Wright Aeronautical Corporation in 1929.

When you buy

SPOOLS and REELS

consider the advantages "American" offers

✓ The skill and experience to make them right.

✓ The capacity to meet your needs.

We have the tools, the dies, and all the modern equipment necessary to produce pressed-steel spools and reels skillfully, quickly, and economically.

Widely used in the wire industry for production operations and shipping, "American" Pressed-Steel Spools are light, clean, and sturdy. They will not break, chip, crack, or warp.

"American" Pressed-Steel Reels are equally indestructible. They meet every requirement of braiding, drawing, annealing, vulcanizing, and shipping.

The services of our Engineering Department are available, without obligation. Let us quote on your requirements.

The American Pulley Company
4255 Wissahickon Avenue, Phila., Pa.

Special Representative
WALTER A. RICHARDS
20 N. Wacker Drive
Chicago, Ill.

AMERICAN
Pressed-Steel
SPOOLS AND REELS

1940 Supplement to Book of A.S.T.M. Standards

TO keep up to date its trienially published Book of Standards, the American Society for Testing Materials in the two intervening years issues Supplements to each part of the book. The 1940 Supplement, recently issued in three parts, gives in their latest approved form 292 specifications, tests, and definitions which were either issued for the first time in 1940 or revised.

✦ ✦ ✦

PART I on Metals, with 100 standards, covers some 500 pages including 48 specifications covering ferrous metals—iron castings, steel, etc.; 49 specifcations pertaining to the non-ferrous field —aluminum and aluminum alloys, magnesium and magnesium alloys, copper and copper alloy castings, and lead and lead alloys; and three general testing methods.

✦ ✦ ✦

PART II includes 91 standards and comprises 350 pages covering the non-metallic materials used for constructional purposes. Specifications and tests cover cement, gypsum, refractories, glass, concrete and concrete aggregates, etc.

✦ ✦ ✦

PART III, the largest volume, covers the following materials: coal and coke, petroleum products and lubricants, electrical insulating materials, plastics, rubber products, textile materials, paper, etc.

✦ ✦ ✦

COPIES of these Supplements can be obtained from the A. S. T. M. Headquarters, 260 S. Broad St., Philadelphia, at $3 for any one part, $5 for any two parts, and $7 for all three parts. Each Supplement is bound in durable cloth binding with the back-strap designed to match the Book of Standards. Half-leather bindings are also available upon the additional payment of $1 per part.

✦ ✦ ✦

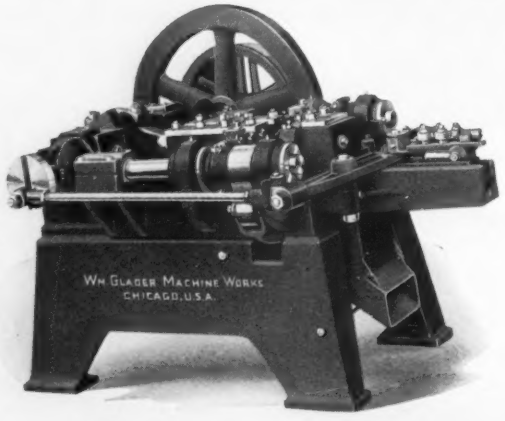
Reduction of Dross Formation in Hot Dip Galvanizing By the Use of Zinc Ammonium Chloride Pre-dips

"REDUCTION of Dross Formation in Hot Dip Galvanizing By the Use of Zinc Ammonium Chloride Pre-Dips" was the title of a paper presented at the Annual Meeting of the American Hot Dip Galvanizers Association held at Pittsburgh, Pa., recently.

✦ ✦ ✦

THIS paper and discussion by **R. J. Kepfer,** research chemist, Grasselli Chemicals Department, E. I. du Pont de Nemours Company, Cleveland, O., was the result of a study made on the difference in amount of dross produced when galvanizing pieces of low carbon steel which have been pre-dipped in Grasselli zinc ammonium chloride solutions as compared to using similar steel pre-dipped in dilute muriatic acid. While there were some variations depending upon the strength of pre-dip solution used and on the time of standing between pre-dipping, it was generally found that the amount of iron dissolved from the steel by the galvanizing bath was about 60% greater when using fresh muriatic acid pre-dip than when using a solution of zinc ammonium chloride. Conversion of the figures for

HIGH SPEED WIRE NAIL MACHINE



WM. GLADER MACHINE WORKS

210 N. Racine Ave. Chicago, Illinois

Glader Machines on large head, single-blow roofing nails can be seen in operation at any of the independent wire mills in the United States.

The production figures on common nails shown below, are guaranteed.

SIZE MACH.	SIZE WIRE	MAX. LENGTH OF WIRE	NUMBER OF NAILS PER MIN.	CAP. IN POUNDS PER HR.
#00A	#16	1⅛"	700	37.2
#00	#14	1¼"	550	55
#0	#12	1¾"	450	89
#1	#10	2½"	400	192
#2	#8	3½"	325	310
#3	#4	5"	225	523
#4	#1	7"	190	622
#4s	5/16"	9"	175	1155
#5	⅜"	12"	160	2400

This high output and economical operation account for the GLADER machine being accepted as standard equipment in all recent installations.

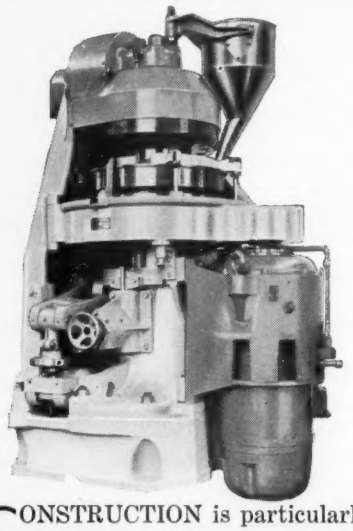
iron dissolved to dross formation it was found that an average dross saving of about 11 pounds per 5,000 square feet of surface galvanized was obtained when using a zinc ammonium chloride solution pre-dip. In other words, for each ton of zinc used for coating purposes, a minimum of 55 to 60 pounds more dross was formed when using a muriatic acid pre-dip than when using a solution of zinc ammonium chloride.

✦ ✦ ✦

Large Rotary Tablet Compressing Machines

THE F. J. Stokes Machine Co., Philadelphia, is offering a new and larger rotary tablet compressing machine capable of applying 30 tons pressure and producing parts with a maximum diameter of 2½". This machine has a maximum die fill of 4", is arranged for making cored and special-shaped pieces, has ten sets of punches and dies and applies pressure from both top and bottom simultaneously.

✦ ✦ ✦



CONSTRUCTION is particularly rugged, of steel and semi-steel throughout. Weight is 16 thousand pounds; height 8'4". Motor drive is direct, through geared speed reducer. A patented, combined pressure equalizer and automatic excess pressure release is provided to spill overloads and prevent jamming or breakage. The output of the machine is 150 pieces per minute when the full number of 10 punch and die sets are in use. Limited production is possible, if desired, by using only one or a few sets of punches.

ALL-METAL
FINE WIRE SPOOLS

For Winding and Shipping Fine Steel, Copper, and Enameled Wires

★

Non-Snag winding, light weight, safe and convenient shipping of your fine wires—these are advantages of using an All-Metal Clark Spool. The reasons for these advantages are to be found in the design, construction, and materials used in the spool:

Metals tested for maximum rigidity.

Locked-seam barrel and one-piece ends, permanently and smoothly assembled —no chance of trapping wire at the joint.

Full curl on ends—no rough edges.

Identifying copy embossed in ends.

Finish—gold or copper lacquer, or a variety of colored lacquers.

Spool sizes: 2-7/16" or 3" diameter ends; 2-7/16" size made with 1½" diameter barrel only, the 3" diameter with 1½" or 1¾" diameter barrel; length of barrel to suit your winding needs.

We will send samples at your request.

J. L. CLARK MANUFACTURING CO.
600 23rd AVENUE • ROCKFORD, ILLINOIS

ROTARY Tablet Machines of this type are widely used for compressing oilless bearings, iron core magnets, valve seats, iron gears, pump seal rings, motor brushes and many similar products of powder-metallurgy.

✦ ✦ ✦

THEY are used also for compressing chemicals, explosives, dry cell plates, salt sticks and salt cakes, ore briquettes, molding powder preforms, and many other materials and products.

✦ ✦ ✦

Abrasive Pioneer and Vice President of Norton's Dies

LEWIS E. SAUNDERS, 67, a vice president of Norton Company, Worcester, Mass., and pioneer in the development of electric furnace abrasives, died February 20 after an illness of two weeks. He had been in poor health for several months.

✦ ✦ ✦

MR. SAUNDERS had been vice president of Norton Company since 1937, and a director since 1921. He also formerly was manager of the company's abrasive plants and research laboratories. In January, he gave up most of his active responsibilities, and had served since as a consultant.

✦ ✦ ✦

BEFORE joining Norton Company he was associated in Ampere, N. J., with Charles B. Jacobs, who developed the process of making the aluminous abrasive known as Alundum. This product was acquired by the Norton Company in 1900, and Mr. Saunders became associated with the Worcester company three years later.

✦ ✦ ✦

HE served variously as chemical engineer, metallurgist and superintendent of abrasive plants and research laboratories. He had long been recognized as one of the nation's leading authorities on electrochemical production of abrasives.

✦ ✦ ✦

HE was a member of American Electrochemical Society, American Chemical Society, Society of Chemical Industry of Great Britain, Worcester Club and Tatnuck Country Club.

Anchor Strapping for Car Door Bracing

STEEL Strapping is generally recognized by shippers of carload freight as the modern, more efficient, more economical means for protecting carload freight in transit.

✦ ✦ ✦

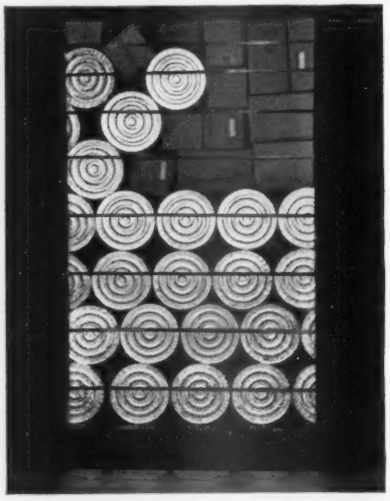
THE Signode Steel Strapping Company of Chicago, Illinois, has introduced a special specification steel strapping, called Anchor Strapping, for car door bracing solid carloads of cartoned, bagged and loose bulk commodities.

✦ ✦ ✦

THE manufacturer claims Anchor Strapping usually costs less, is faster to install, makes it possible to better fit the protection to the commodity, and makes it easier and faster for the receiver of solid carload freight to make the car ready for unloading. Anchor Strapping is fabricated with centered, continuously punched holes, making it faster and easier for the cooper to install. The continuous perforations makes it possible for the strapping to be cut to any economical length desired. There are always the much desired centered punchings at the ends of the cut lengths for fast accurate nailing.

✦ ✦ ✦

PRACTICALLY every industry, according to the manufacturer, benefits from the new Anchor Strapping. Many commodities fabricated from steel, such as the galvanized wire illustrated, benefits from this Anchor Strapping Method of Car Door Bracing. The merchandise is prevented from shifting out of its original position thereby preventing damage from impact in the doorway recess, damage from contact with the permanent car door when it is opened, and prevents freight from falling out of the car when the door is opened. The comparative weight of Anchor Strapping is negligible and in many cases makes big dunnage cost reductions for the shipper.



Signode Anchor Strapping is car door bracing this mixed solid carload of stamped steel products. (Galvanized pails and water cooler parts) ✦

A NEW completely illustrated bulletin, "Car Door Bracing Solid Carloads with Signode Anchor Strapping", will be mailed on request of the Signode Steel Strapping Company, 2700 N. Western Ave., Chicago, Illinois.

✦ ✦ ✦

Germany Important Supplier of Insulated Wire

GERMANY was an important supplier of "wire of common metals and alloys thereof, insulated but not armored," over half the Mexican imports coming from that country despite strong competition of the United States. Imports of armored wire of this type are less; these formerly came from Italy and Germany as well as America. Substantial quantities of cable, armored and unarmored. Germany was formerly the chief source; Canada has now taken a share of the trade. Underground cables seem to be almost entirely supplied by one American manufacturer. It is reported that shortly there will be a large demand for cable for improved airport lighting as part of the Pan American defense scheme.

✦ ✦ ✦

IN addition to the Consolidada, there are four other local factories producing wire. Lighting flexible is also made locally, but Japan is the principal foreign source. Conduits, which formerly came from Germany, are likewise manufactured in Mexico. American prices are 25 percent higher than the domestic. Opportunity exists for the supply of the heavier conduit and fittings which are used in Mexico's many mines.

WIRE WISDOM

Just a little RODINE in the pickling bath saves acid and metal, minimizes brittleness, lowers pickling costs. RODINE more than pays its way.

CUPRODINE creates a denser, tighter, brighter and more uniform copper coating, in less time. Provides better lubrication for drawing than ordinary coating.

Write for details.

American Chemical Paint Co.
Main Office and Factory
AMBLER, PENNA.

ANNOUNCING

Combined Wire Drawing and Electric Annealing Machines in Operation, 30 to 36 B&S at 7000 ft. per min.
ALSO—
Combined Wire Drawing, Electric Annealing and Continuous Spooling Machines in Operation, 14 to 18 B&S at 3000 ft. per min.
Machines Under Construction 8 to 16 B&S at 2500 ft. per min.

JOHN COOK ENGINEERING COMPANY
265 North 9th St., Prospect Park
Paterson, N. J.

Longer Die Life, Brighter Wire, Shorter Baking Time

Today's urgent necessity to speed-up production makes it important to investigate every method, material or new development that helps achieve this end.

In many well-known wire mills the standardized use of Oakite Composition No. 24 and other Oakite materials for de-greasing and drawing wire has resulted in longer die life, brighter wire, shorter baking time and other advantages. We shall be glad to work with you and make tests to help you establish the same results in your mill.

Since there is no obligation, won't you write us today?

OAKITE PRODUCTS, INC.
52A THAMES ST. NEW YORK, N. Y.
Representatives in all Principal Cities of U. S. and Canada

OAKITE CERTIFIED CLEANING
MATERIALS METHODS SERVICE

IMMEDIATE RECOGNITION!
ACCORDED THIS FOUR-STAR BOOK

★ Practical ★ Original ★ Interesting ★ Complete

From all quarters has come commendation of this latest ASM book on practical metallurgy. Already four famous engineering schools—Case School of Applied Science . . . University of Wisconsin . . . Brooklyn Polytechnic Institute . . . Stevens Institute of Technology — are planning to use this book as a textbook for their courses in metallurgy.

Typical of other responses is that from Dr. Zay Jeffries, General Electric authority, who says: "The book constitutes a valuable addition to the literature of metallurgy".

If you haven't ordered your copy, do so today. You'll agree when you receive "Practical Metallurgy" that this is the finest book on this subject available today.

PRACTICAL METALLURGY

Applied Physical Metallurgy — Industrial Processing of Ferrous and Nonferrous Metals and Alloys

by

GEORGE SACHS,
Case School of Applied Science
and
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In addition to 335 general illustrations, PRACTICAL METALLURGY contains 160 constitutional diagrams covering all systems that contain an important commercial alloy. These diagrams . . . the chapters on Plastic Deformation of Ferrous and Nonferrous Metals . . . and the chapter on Internal Stress in Metals contain information not available in any other book published in this country.

Here is the book you've long wanted — a simple yet complete treatise on practical metallurgy.

WIRE & WIRE PRODUCTS
300 Main Street Stamford, Conn.

F. J. Wedge, Superintendent, Wire Mill, Spencer Steel Company

THE appointment of **Frederick J. Wedge** as superintendent of mills has been announced by the Spencer Wire Company. Mr. Wedge was formerly employed as supervisor of the fine wire department of the Wickwire Spencer Steel Company in Buffalo. His return to the mills in wire village, where he learned wire drawing thirty-seven years ago, continues the family name in connection with these mills for over 100 years. Three of the seven mills now in operation are under the supervision of Mr. Wedge.

✦ ✦ ✦

Norton Company Announces Changes in Sales Department

A NUMBER of sales department changes are announced by the General Sales Manager of Norton Company, Worcester, Mass., as follows:

R. O. Anderson, from District Manager in Pittsburgh to Worcester where he will report directly to W. R. Moore, General Sales Manager;

C. B. Price, from the Southeast section to District Manager at Pittsburgh;

Lorin W. Grubbs who has been assisting Mr. Price in the eastern part of his section will continue to serve that area and Zachary M. Almand from Sales Engineering department at Worcester will take over the western part of this territory;

G. T. Taylor, from New York City area to the Chicago district;

J. S. Anderson from Pittsburgh to New York;

W. A. Russell, Field Engineer in Pittsburgh, will take over Mr. Anderson's Pittsburgh sales territory;

J. L. Tobey of the Sales Engineering department at Worcester becomes Field Engineer at Pittsburgh;

J. E. Strachan, Jr., recently Field Engineer in New England, has been assigned as a salesman in southern Ohio.

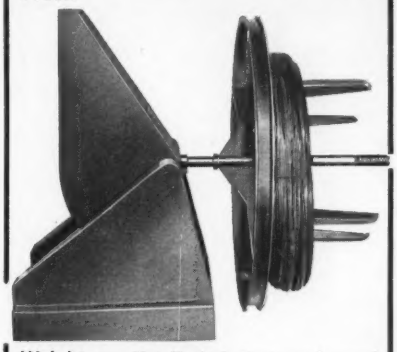
✦ ✦ ✦

New Company to Manufacture Nickel Alloys and Products

THE organization of the American Nickel Alloy Manufacturing Corporation has been announced. Mr. Alfred J. Grunebaum, who is head of the Anglo-American Metal & Ferro-Alloy Corporation, sellers of metals, ores and chemicals, is president of the new company. Executive offices are located at 50 Church Street, New York City.

THE "SHIFTWEIGHT" TILTING WIRE REEL

A counter-balanced tilting wire reel with full 42" diameter upper guard rings, allowing perfect feeding of wire off the coil and absolutely "Snarl Proof."

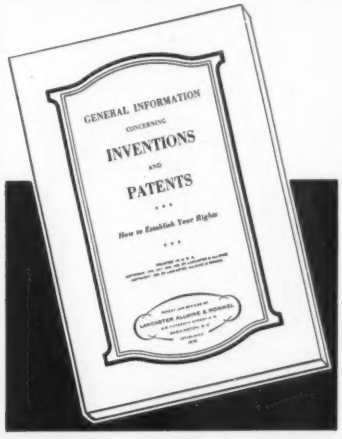


Weight so distributed that reel need not be bolted to floor.

Dealers inquiries invited.

Moslo Machinery Inc.
5005 Euclid Ave.
Cleveland Ohio

Wire Reels Rod Bakers
Spot Welders Roll Straighteners
Wire Straightening and Cutting
✦ ✦ ✦ Machines ✦ ✦ ✦



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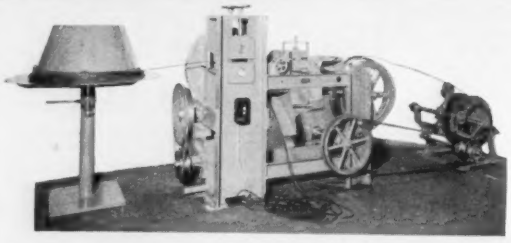
No charges are made for preliminary advice, either in connection with patent, trade-mark or copyright cases.

Lancaster, Allwine & Rommel
Registered Patent & Trade-Mark Attorneys
438 Bowen Bldg., Washington, D. C.



WIRE INSULATION STRIPPER

EST. 1855 AIMCo INC. 1918
"American" INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.
517 West Huntingdon St.
PHILADELPHIA PENNSYLVANIA U.S.A.

for reclaiming weather proof wire from open coils. Removes covering, straightens the wire and winds with traverse on reels.

Motor driven, ball bearing throughout and mounted on welded steel frames.

MACHINES

FOR THE WIRE INDUSTRY

for BUNCHING • BRAIDING • CABLING • COILING • CLOSING • MEASURING • STRANDING • TWISTING

A complete line of standard machines; also special machines designed or built to order. Let us know your requirements.

NEW ENGLAND BUTT COMPANY

PROVIDENCE, R. I. CHICAGO, ILL.

European Agency: James Day (Machinery) Ltd., The Grange, Whetstone, Nr. Leicester, England.

NATIONAL RUBBER MACHINERY CO.

AKRON, OHIO

Manufacturers of Equipment for the Rubber, Wire, Wire Rope, Electric Cable, and Plastic Industries.

Improved Insulating Machinery for Western Electric Continuous Vulcanizing Process.

Plants: Akron, Ohio; Columbiana, Ohio; Clifton, N. J.

Main Office: Akron, Ohio
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David Bridge & Co., Ltd., Manchester, England

NILSON

AUTOMATIC PRESS AND FOUR SLIDE MACHINE

FOR SWAGING, STAMPING, PIERCING, BLANKING, FORMING OF COILED METAL

WE also build machines for forming Paper Clips, Buckles, Gate Hooks, Coat and Hat Hooks, Ceiling Hooks, Wire Ears, Cable Rings, Screw Eyes, Sash Chains, Automobile Side Chains, Flat Open Link Chains, Staples, Cotter Pins, Hose Clamps, Etc., and Wire Straighteners, Wire Reels, Frame Bending Machines and Special Presses.

For Complete Details Address —

THE A. H. NILSON MACHINE CO.

BRIDGEPORT, CONN., U. S. A.

Carboloy Triples Metal Production Capacity

AN expansion program which, when completed, will triple carbide metal production capacity is nearing completion at the new plant of the Carboloy Co., Inc., Detroit, largest producers of cemented carbide for cutting tools, dies, etc.

✦ ✦ ✦

COMPLETED in 1939, the Carboloy plant at that time had a production capacity several times the amount of tungsten carbide then being consumed by industry, with provision for further expansion within the plant. The new program provides for absorbing, for production needs, all previously available and unassigned floor space in addition to which the construction of a new warehouse will release further main plant area for productive uses.

✦ ✦ ✦

TOTAL increase in productive floor space under the program is approximately 23,000 square feet. The plant is at present operating on a three shift basis, while certain sections of office personnel are on a two-shift basis. Since the new plant was completed, employment has approximately tripled, in the shop alone.

✦ ✦ ✦

INDICATIVE of the growing requirements for carbides in industry is an approximate quintupling of floor space required for packaging and finished stock, a large proportion of which is required for the new low-price standard tools, while raw material and powder in process is inventorying double the amounts current last year.

✦ ✦ ✦

PROVIDED for in the expansion program are: addition of new hydrogen atmosphere furnaces, raising the total to thirty from the original eighteen, doubling the equipment for sifting, grading and mixing the powdered metal; a new pill press with larger size range than previously available; an hydraulic slab press with twice the capacity of present presses; 18 new machines in the milling department; 7 new lathes for machining

round hole dies and casings as well as new equipment for forming, sandblast and painting, machining, grinding, etc.

✦ ✦ ✦

THE expansion according to Carboloy officials is in line with the company policy of keeping production facilities ahead of all possible requirements of industry, including national defense needs.

✦ ✦ ✦

Ralph K. Clifford Elected Director, Continental Steel Corp.

RALPH K. CLIFFORD, since 1939 vice president in charge of operations for all of the plants of the Continental Steel Corporation at Kokomo and Indianapolis, Ind., and Canton, Ohio, has been elected as a member of the board of directors of the company. Announcement of the election was made by **D. A. Williams**, president of the company.

✦ ✦ ✦

MR. CLIFFORD began his career in the steel industry in 1907 with the Kokomo Steel & Wire Co., which in 1927 became a part of the Continental Steel Corporation. He worked in various departments of the Kokomo plant during school vacation periods while a student at the University of Michigan. Following his graduation from the University in 1914, Mr. Clifford spent two years as a teacher of chemistry and physics in Michigan High Schools.

✦ ✦ ✦

IN 1916, Mr. Clifford was named chief chemist of the Kokomo plant, and later also held positions as chief metallurgist and chief inspector. He was appointed assistant general superintendent of the Kokomo plant in 1923, becoming general superintendent two years later. He was named works manager of the Kokomo division in 1937.

✦ ✦ ✦

MR. CLIFFORD has been an active member of the Wire Association and is a past president of this organization. He also is a member of the executive committee of the Open Hearth committee of the American Institute of Mining and Metallurgical Engineers.

Learn about PARALAN

Paralan will give your finished wire and wire products protection from atmospheric corrosion in the mill and in shipping. Paralan-coated wire can be spot welded or soldered without cleaning. Also, Paralan leaves surfaces in good condition for all types of finishes—enameling, japanning, lacquering, plating, etc.

Write for further information. We may be able to solve your difficulties.

AMERICAN LANOLIN CORP.
LAWRENCE, MASSACHUSETTS

WIRE DRAWING LUBRICANTS FOR
HIGH OR LOW CARBON WIRE, COLD HEADING,
BRIGHT AND WET WIRE DRAWING.

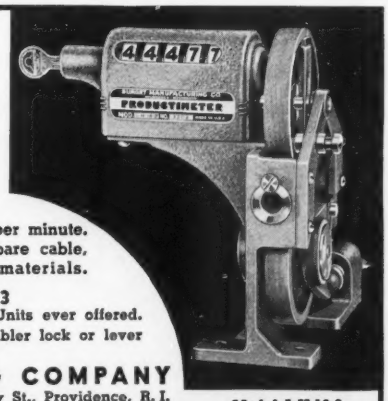
STANDARD "WIRE DRAW"

SPECIALLY ADAPTED FOR HIGH SPEED DRAWING MACHINES
BETTER FINISHED WIRE — LOWER DIE COSTS

STANDARD INDUSTRIAL COMPOUNDS CO.
CHICAGO, ILLINOIS

MEASURE *Wire and Cable*
THIS DEPENDABLE WAY

Productimeters are built strong, durable, for long hard usage . . . designed with customary DURANT precision for accurate, speedy performance. CAPACITIES — up to 3½" dia. SPEEDS — 800 to 5000 counts per minute. MODELS for braid and fabrics as well as bare cable, insulated wire, chain and for oily, greasy materials.

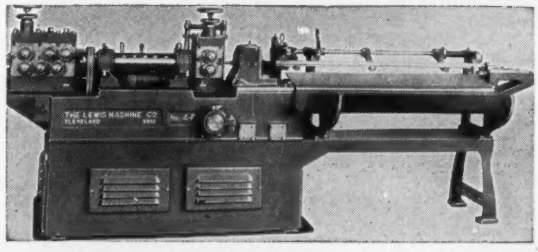


SEND FOR CATALOG No. 3
for the most complete line of Wire Measuring Units ever offered.
L-H-16-2 illustrated, is made with wing nut, tumbler lock or lever resets. Capacity: .01" to ½".

DURANT MANUFACTURING COMPANY
1918 N. Buffum St., Milwaukee, Wis. • 176 Eddy St., Providence, R. I.

Model L-H-16-2

LEWIS TRAVEL-CUT WIRE STRAIGHTENING and CUTTING Machines



Machines for 1/16" to ¾" rod
Round
Square
Flat
Hexagon
Ferrous and Non-Ferrous

Automatic
High Speed
Heavy Duty

The Sign of Dependable Service:
WE CAN SUPPLY AND ENGINEER OUR TOOLS EQUIPPED WITH CARBOLOY CEMENTED CARBIDE

THE LEWIS MACHINE CO., 3445 E. 76 St., Cleveland, Ohio

New Priorities Critical List

A NEW and revised "critical" list including a number of important items which have not appeared on the priorities list before, was recently announced by **E. R. Stettinius, Jr.**, Director of Priorities for the OPM.

THE material of particular interest to the wire industry included the following:

Aluminum and aluminum alloys, pig or fabricated.
Bearings, roller and ball.
Brass, pig and fabricated.
Bronze, pig and fabricated.
Cables, electric, under water, fire control, lead sheath or lead and armor, degaussing, including assemblies.
Calipers, micrometer.
Castings, steel, heavy, brass (over 150 pounds), aluminum.
Chromium alloy steel.
Coils, service specifications.
Cutters, wire and carriers (special service types).
Diamond point tools
Dies, diamond.
Electric generators, motors and motor generators, dynameters; all except N. E. M. A. standard types, meeting A. I. E. E. specifications and rules.
Forgings; brass, steel, aluminum.
Gauges, inspection.
Jigs and fixtures.
Machinery; forging, power-driven, for casting, cutting, grinding, hoisting, melting, metal pressing, welding, refrigerating.
Magnesium and alloys, pig or fabricated.
Monel metal.
Nickel, pig or fabricated.
Nickel, alloy steel.
Rubber, synthetic, rubber-like synthetic materials.
Steel, electric furnace, bullet, armorplate, special treatment, tungsten, nickel, chrome, vanadium.
Telephones, all special service types, radio and equipment.
Telegraph sets (service specifications)
Tin
Tungsten, ferro tungsten and tungsten ore.
Tungsten alloy steel.
Vanadium and vanadium alloys.
Wires, service types (see conductor), field (S.C.).
Zinc.

✦ ✦ ✦

MR. STETTINIUS announced that informal working arrangements had been completed between the Army and Navy Munitions Board and the Priorities Division of the OPM and that such arrangements had been reduced to a formal plan for the operation of the priorities system.

ONE of the major changes provided in the formal plan, which follows the temporary working arrangement announced Feb. 17th is that the Army and Navy Munitions Board, its officers and agents, will now administer the assignment of preference rated to Army and Navy orders not only for prime contracts and first subcontracts, but also for all other sub-contracts for critical list items entering into such orders.

✦ ✦ ✦

AS in the past, the Army and Navy Munitions Board will operate wholly within the framework of the priorities critical list. A number of new items have been added to the priorities critical list including those recently subjected to industry-wide mandatory priorities, such as aluminum, magnesium, neoprene and nickel. Allocation of such products by the Priorities Division will take precedence over ratings assigned by the Army and Navy field staffs when shortages are so acute as to make necessary a diminution of quantities flowing to military channels. Authority for the priorities system is vested in the Director of Priorities and the Priorities Division of the O.P.M. and all priorities certificates will go out over the signature of Mr. Stettinius but will be actually distributed by the Army and Navy field services when the material involved is on the priorities critical list.

✦ ✦ ✦

(1) The first administrative order of the Director of Priorities providing formal authorization for the handling of priorities for items on the priorities critical list by the Army and Navy Munitions

Diamond Dies for Wire Drawing
Wayne Wire Die Co., Inc.
133 Mountain Rd.
Jersey City, N. J.
Tel.: Journal Square 4-4311

FOR DIAMOND AND CARBIDE WIRE DRAWING DIES SEE
RUSCH WIRE DIE CORPORATION
275 Seventh Ave., New York, N. Y.

DIAMOND DIES
.000's to .102
Fort Wayne Wire Die, Inc.
2002 S. Harrison Fort Wayne, Ind.

VIANNEY
Famous Wire Drawing Diamond Dies

These famous Diamond Dies are now produced here at moderate prices.
All sizes are in stock or made to order to your specifications
VIANNEY WIRE DIE WORKS
250 E. 43rd. St. New York.
V. J. Boulin, Manager

Wire Drawing and Extrusion Dies made of
DIAMONDS, COMPOSITION, etc.
F. KRAUSE & COMPANY, INC.
250 Ogden Ave. Jersey City, N. J.
Phone JOurnal Square 4-5105

DIAMOND CARBIDE
DIES
KELLY
WIRE DIE CORPORATION
19 W. 34th St. New York

Wire Drawing Diamond Dies
COCHAUD
WIRE DIE CORPORATION
300 W. 56th St., NEW YORK
Tel. Col. 5-1340

Hy-Carbo Steel Co.
EST. 1917
✦ ✦ ✦
HIGH GRADE CUSTOM WIRE DRAWING
In Rounds
Less Ton Lots A Specialty
✦ ✦ ✦
LOWELL, MASS.

Continuous Straightening and Cutting Machinery
With
FLYING SHEAR
for round and shaped wire.
✦ ✦ ✦
THE HALLDEN MACHINE COMPANY
THOMASTON CONNECTICUT

UNIVERSAL WIRE REEL
Quickly and easily adjusted to any angle within 90 degrees. Cut shows one angle.
Write for circular R
THE F. B. SHUSTER CO.
New Haven, Conn.
Straightener Specialists Since 1866

Board, and validating previous priorities orders and actions.

(2) The priorities critical list, never before made generally public, setting forth all items on which the Army and Navy field service can automatically assign priority ratings.

(3) The official instructions from the War and Navy Departments to their supply arms, services, bureaus and offices.

(4) A revised circular bringing up-to-date the description of the priorities system in operation.

✦ ✦ ✦

Civilian Priorities

THE Division will continue to handle directly the assignment of ratings for items not on the critical list, (including raw materials not on the list), for important civilian projects, and the priority actions for the allocation of certain materials which must be handled on an industry-wide basis. Such direct allocations by the priorities division may modify individual priority certificates.

✦ ✦ ✦

PROVISIONS in connection with the revised system announced today include:

(1) The Army and Navy Munitions Board will assign ratings to prime contracts of certain foreign governments, including Great Britain and Canada, and provision is made for the extension of these ratings to subcontracts.

(2) Only an official preference rating certificate will be binding, but manufacturers will be encouraged to inform their subcontractors and suppliers as to what ratings may be extended to their work if a priority certificate is requested and issued. This will enable subcontractors to plan for readjustments which might be necessary if and when a preference rating certificate is issued.

(3) A completely new set of forms will be issued in operating the priorities system. However, previously issued certificates and extensions, properly issued and executed will remain valid.

(4) In special situations, such as the case of companies engaged almost wholly in defense work, or in case of special urgency in connection with a particular defense project, the priorities division is prepared to grant authority for the automatic use of limited blanket ratings which will be valid for a limited period only. Such limited blanket ratings will include a list of the specific items to which the ratings is applicable. A blanket rating of this type was issued to nine crane builders on March 12th.

(5) In administering the system, the priorities division can give priority aid to important civilian projects, as well as military projects for foreign orders, and will continue to see to it that civilian needs are carefully balanced with defense needs at all times.

(6) The preference rating certificate will continue to be the principle administrative mechanism in the operation of the system. These certificates or ratings may be applied "automatically" to Army and Navy orders by the Army and Navy Munitions Board and its agents for items on the priorities

(*Please turn to Page 256*)

GEORGE D. HARTLEY
CONSULTANT & SPECIALIST
In Wire Manufacturing & Wire Forming Equipment
Development & Research
New Processes — Designing
Inventions — Patents
372 MAY ST., WORCESTER, MASS.

KENNETH B. LEWIS
CONSULTING ENGINEER
Wire Mill Equipment, Layout and Practice
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WIRE MACHINERY SPECIALISTS
3—Nilson No. 1, 3 & 4 4 Slide Wire Machines
2—Baird No. 3 & S3F 4 Slide Wire Machines
7—Waterbury Step Cone Wire Drawing Machines
1—Two Spindle Bull Block Motor Driven
6—Lewis Welding Wire S & C Machines M. D.
2—Shuster Shaped Wire S & C Machines ½" & ⅞"
8—Shuster Round Wire S & C Machines 1/32"-½"
Wanted: Tack Making Machinery. All Sizes.
NATIONAL MACHINERY EXCHANGE
128-138 MOTT ST. NEW YORK, N. Y.

MOSSBERG
PRESSED STEEL CORP.
ATTLEBORO, MASS.
STEEL REELS AND SPOOLS

Annealing Pots and Boxes
Galvanizing Kettles
Lead and Spelter Pans
Pressure Vessels
NATIONAL ANNEALING BOX CO.
Established 1895
Washington, Penna.

CLEVELAND TRAMRAIL
Division of
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE, OHIO
Leading manufacturers of
OVERHEAD MATERIALS HANDLING EQUIPMENT
for the Wire and Wire Products Industry

FOR SALE
Bellis Salt Annealing Equipment for Annealing Rods and Wire.
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ZINC STRIP AND WIRE
THE PLATT BROS. & CO.
WATERBURY, CONN.

Designers and Builders of Gas-Fired Heat Treating Furnaces for Ferrous and Non-Ferrous Wire.
SURFACE COMBUSTION CORPORATION
Main Plant and General Offices—Toledo, Ohio

WIRE DRAWING MACHINERY AND EQUIPMENT
Rod Frames — 16" Frames, 8" Frames — Take-Up Frames, Wire Pointers — Puller Tongs.
General Castings for Wire Mill use. Circulars on Request.
E. J. SCUDDER FOUNDRY & MACHINE CO.
TRENTON, N. J.

RUESCH
Machinery For
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Wire Mill and Cold Rolling Equipment
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WIRE, WIRE ROPE AND ELECTRIC CABLE MACHINERY
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APCO MOSSBERG CO.
the original Frank Mossberg Co.
Manufacturers of Reels and Spools
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CREPE PAPER
In rolls of any size for wrapping coils and reels.
CREPE-KRAFT BARREL LINERS
THE CREPE-KRAFT CO., INC.
Tel.: Market 2-0375
112 Adams St. Newark, N. J.

New Priorities Critical List

(*Continued from Page 231*)

critical list. The priorities division, however, may also issue specific certificates for individual contracts, whether the items involved are or are not on the priorities critical list, and may also use such techniques as blanket ratings and industry-wide priorities for allocations in order to accomplish desired objectives.

(7) The priorities critical list will be subject to revision once each month. Items on the list are deemed to include all fabricated parts necessary for the completion, maintenance or operation thereof, which are designed to meet military specifications, and as designed are not commercially useful for ordinary civilian purposes.

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Zinc

THE Priorities Division of the Office of Production Management announced that a plan has been worked out with representatives of the zinc industry to take care of urgent requirements for defense purposes.

✦ ✦ ✦

E. R. STETTINIUS, JR., Director of Priorities for the Office of Production Management, said that under the plan the Priorities Division will instruct each zinc producer month-by-month to set aside a quantity of the metal subject to priority allocation. The allocation will be made by the Division.

✦ ✦ ✦

THE plan will go into effect on production for the month of April. For that month all producers of slab zinc will set aside 5 per cent of their total production. This will create a pool of the metal which can be promptly allocated by the Priorities Division to ease shortages as they may occur in defense industries.

✦ ✦ ✦

OFFICIALS of the Priorities Division believe that the plan, which can be modified from month to month, will make it possible for the zinc industry to meet the present zinc requirements in defense plants.

ROYLE
PATERSON N J
BUILDING EXTRUDERS SINCE 1880
Insulating Machinery for Western Electric Continuous Vulcanizing process.
JOHN ROYLE & SONS
PATERSON, N. J.
British Agency: James Day (Machinery) Ltd., The Grange Whetstone Nr. Leicester, England

MANUFACTURERS OF
WIRE BRAIDING — SPOOLING — TAPING
WINDING AND SPECIAL MACHINES
SINFRA WIRE COVERING MACHINES
FIDELITY MACHINE CO.
3908-18 Frankford Ave., Phila., Pa.

SPARK - TESTING EQUIPMENT FOR
INSULATED WIRE AND RUBBER HOSE
JAMES L. ENTWISTLE
43 CHURCH ST. PAWTUCKET, R. I.

DAVIS
SPARKERS
R. L. DAVIS ELECTRIC CO.
340 Center Street,
Wallingford, Conn.

SCOTT TESTERS
For WIRE, RUBBER, TEXTILES, PAPER, Etc.
HENRY L. SCOTT CO.
PROVIDENCE, R. I.

SPOOLS AND REELS
FOR THE WIRE INDUSTRY
Hubbard Spool Company
1622 Carroll Ave. Chicago, Ill.

WRAPPING MACHINES
Coil & Straight Length
TERKELSEN MACHINE CO.
320 A Street Boston, Mass.

ROLLS
Chilled Iron, Alloy Chilled Iron, Alloy Iron, Dry Sand, Meehanite, Steel, Chromium-Plated, Flame Hardened — For all purposes — Any diameter from 4" to 72"—Any length up to 312" face.
FARREL-BIRMINGHAM
COMPANY, INC.
37 MAIN ST. ANSONIA, CONN.

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WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyers' Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

ACCUMULATORS—
Farrel-Birmingham Co., Inc., Ansonia, Conn.

AIR DRAW FURNACES—
Carl-Mayer Corp., The, Cleveland, Ohio.

ANNEALING MACHINES—Open Flame
Drever, Co., The, Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

AUTOMATIC SPARK TESTING EQUIPMENT—
Entwistle, James L., Pawtucket, R. I.

BAKERS—Hi-Speed
Carl-Mayer Corp., The, Cleveland, Ohio.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Moslo Machinery, Inc., Cleveland, O.
Ross, J. O., Engineering Corp., New York, N. Y.

BANBURY MIXERS—
Farrel-Birmingham Co., Inc., Ansonia, Conn.

BERYLLIUM COPPER—Strip and Bars
Callite Tungsten Corp., Union City, N. J.

BLOCKERS—
Farrel-Birmingham Co., Inc., Ansonia, Conn.

BOBBINS—Braider and Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

CALIPERS—Roll
Farrel-Birmingham Co., Inc., Ansonia, Conn.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CASTINGS—Wire Mill
Farrel-Birmingham Co., Inc., Ansonia, Conn.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIPMENT—
Broden Construction Co., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Lee Wilson Engineering Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CLOTH TESTERS—
Scott, Henry L., Co., Providence, R. I.

CLOTH—Wire, All Metals
Callite Tungsten Corp., Union City, N. J.

COATING—Protective
American Lanolin Corp., Lawrence, Mass.

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

COILERS AND SPOOLERS FOR INSULATED WIRES—
Entwistle, James L., Pawtucket, R. I.

COLD HEADERS—
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Wire Drawing
Standard Industrial Compounds Co., Chicago, Ill.

WHERE TO BUY, Continued

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIAMONDS—Industrial
Callite Tungsten Corp., Union City, N. J.

DIAMOND POWDERS—
Rusch Wire Die Corp., New York, N. Y.

DIAMOND TOOLS—
Rusch Wire Die Corp., New York, N. Y.

DIES—Diamond
Cochaud Wire Die Co., New York, N. Y.
Fort Wayne Wire Die, Inc., Fort Wayne, Indiana
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Inc., Jersey City, N. J.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Jersey City, N. J.

DIES—Lead Extrusion
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Co., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Fort Wayne Wire Die, Inc., Fort Wayne, Indiana
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Inc., Jersey City, N. J.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Jersey City, N. J.

DIES—Rod and Tube Drawing
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.

DIES—Tungsten Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Stevens Metal Products Co., Niles, O.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.
Entwistle, James L., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FLASH BAKER—
Carl-Mayer Corp., The, Cleveland, Ohio

FURNACES—Annealing
Carl-Mayer Corp., The, Cleveland, Ohio.
Drever, Co., The, Philadelphia, Pa.
Electric Furnace Co., Salem, O.
Lee Wilson Engineering Co., Cleveland, Ohio
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Lee Wilson Engineering Co., Cleveland, Ohio
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.
Lee Wilson Engineering Co., Cleveland, Ohio
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Electric
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Hardening and Tempering
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, O.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Salt Bath
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Lee Wilson Engineering Co., Cleveland, Ohio
Surface Combustion Corp., Toledo, Ohio.

GALVANIZING EQUIPMENT—
Lee Wilson Engineering Co., Cleveland, Ohio

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GATES—Blast, For Low Pressure Air
Farrel-Birmingham Co., Inc., Ansonia, Conn.

GEARS—Continuous Tooth Herringbone
Farrel-Birmingham Co., Inc., Ansonia, Conn.

GEARS—Wire Mill
Farrel-Birmingham Co., Inc., Ansonia, Conn.

GRINDERS—Roll
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Norton Co., Worcester, Mass.

HI-SPEED BAKERS—
Carl-Mayer Corp., The,, Cleveland, Ohio.

HOISTS—Electric Travelling
Cleveland Tramrail div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

INHIBITORS—
American Chemical Paint Co., Ambler, Pa.

INSTRUMENTS—Electrical
Entwistle, James L., Pawtucket, R. I.

KETTLES—Galvanizing, Annealing, Tinning, etc.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LUBRICANTS—For Metal Cutting Stamping and Drawing
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY — Armoring (Cable, Wire Hose)
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.

MACHINERY—Bunching
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y. Co., Phila., Pa.
Entwistle, James L., Pawtucket, R. I.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Coilers
Broden Construction Co., Cleveland, O.
Entwistle, James L., Pawtucket, R. I.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
Cook, John, Engr. Co., Paterson, N. J.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Covering Wire
Fidelity Machine Co., Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
Moslo Machinery, Inc., Cleveland, O.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Die Making
Firth-Sterling Steel Co., McKeesport, Pa.

MACHINERY—Draw Benches
Standard Machinery Co., Providence, R. I.

MACHINERY—Edging
Standard Machinery Co., Providence, R. I.

MACHINERY—Enameling
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Extruding
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.
Royle, John & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

WHERE TO BUY, Continued

MACHINERY—Forming
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Galvanizing
Lee Wilson Engineering Co., Cleveland, Ohio

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Lee Wilson Engineering Co., Cleveland, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Grinding, Roll
Farrel-Birmingham Co., Inc., Ansonia, Conn.

MACHINERY—Insulating
American Insulating Mach'y. Co., Phila., Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Fidelity Machine Co., Philadelphia, Pa.
National Rubber Machinery Co., Akron, O.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MACHINERY — Measuring Wire & Cable
Davis, R. L., Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Paper Covering Wire
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
Farrel-Birmingham Co., Inc., Ansonia, Conn.
National Rubber Machinery Co., Akron, O.
Royle, John & Sons, Paterson, N. J.

MACHINERY—Rubber Strip Covering
Farrel-Birmingham Co., Inc., Ansonia, Conn.
National Rubber Machinery Co., Akron, O.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
Farrel-Birmingham Co., Inc., Ansonia, Conn.
National Rubber Machinery Co., Akron, O.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y. Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
National Rubber Machinery Co., Akron, O.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
Moslo Machinery, Inc., Cleveland, O.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Stranding
National Rubber Machinery Co., Akron, O.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Entwistle, James L., Pawtucket, R. I.
Scott, Henry L., Co., Providence, R. I.

MACHINERY—Testing Size of Wire
Davis, R. L., Electric Co., Wallingford, Conn.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Testing—Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
Shuster, F. B., Co., New Haven, Conn.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.

MACHINERY—Winding
American Insulating Mach'y. Co., Phila., Pa.
Entwistle, James L., Pawtucket, R. I.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Mach'y. Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Cook, John, Engr. Co., Paterson, N. J.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Durant Mfg. Co., Milwaukee, Wis.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Rope
National Rubber Machinery Co., Akron, O.
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MACHINERY—Wrapping Wire
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MILLS—Rod, Bar, etc.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

MILLS—Strip, Hot and Cold For Iron, Steel, Copper, Brass, etc.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., The, Torrington, Conn.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Industrial
Carl-Mayer Corp., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

WHERE TO BUY, Continued

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Inc., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lead Melting
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.

PRESSES—Hydraulic and Mechanical
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

RECORDERS—Fault and Reel
Entwistle, James L., Pawtucket, R. I.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Moslo Machinery, Inc., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Constant Tension
Farrel-Birmingham Co., Inc., Ansonia, Conn.

REELS—Steel
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS AND SPOOLS—Shipping and Shop
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Takeoff
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Vulcanizing and Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Moslo Machinery, Inc., Cleveland, O.
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.

ROLLS—Iron, Steel, Alloy
Farrel-Birmingham Co., Inc., Ansonia, Conn.

ROLLS—For Strip, Rod, Bar Mills
Farrel-Birmingham Co., Inc., Ansonia, Conn.

ROLL STRAIGHTENERS—
Moslo Machinery, Inc., Cleveland, O.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUND—
American Lanolin Co., Lawrence, Mass.

SHEET—Steel
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Standard Industrial Compounds Co., Chicago, Ill.

SOLDER—
Kester Solder Company, Chicago, Ill.

SPARK TESTING EQUIPMENT—
Entwistle, James L., Pawtucket, R. I.

SPOOLS—Annealing and Wire Drawing
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Chicago, Ill.

SPOOLS—Shipping and Shop
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Steel
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TAKE-UPS FOR CABLE, HOSE, LEAD PRESSES AND SHEET RUBBER—
Entwistle, James L., Pawtucket, R. I.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TENSILE TESTERS—
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Entwistle, James L., Pawtucket, R. I.
Scott, Henry L., Co., Providence, R. I.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power Driven
Standard Machinery Co., Providence, R. I.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y. Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Micro Products Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE DRAWING — High Grade Custom
Hy-Carbo Steel Co., Lowell, Mass.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.

WIRE—Enameled For Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Nickel Silver and Phosphor Bronze
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.

WIRE—Non Ferrous to Specification For Special Purposes
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE SOLDER—
Kester Solder Company, Chicago, Illinois

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Stainless Steel—
Callite Tungsten Corp., Union City, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE TESTERS—
Scott, Henry L., Co., Providence, R. I.

WIRE, WEAVING—Non Ferrous
Hudson Wire Co., Ossining, N. Y.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Inc., Newark, N. J.

YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.

HUDCO

SPECIALIZES

WINCO

HUDSON WIRE CO. PLANT AT OSSINING, N. Y.

HUDCO AT OSSINING PRODUCES FINE WIRES IN ALL METALS.

FINE BARE WIRES

High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper.

Cadmium, Nickel Silver, 10%, 18%, and 30%; Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

WIRES FOR METAL SPRAYING

Pure Lead, Lead Alloy, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire, High Conductivity, Electric Wire.

Cadmium, Nickel Silver, (10%, 18%, 30%); Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze.

"HUDCO" SPECIALLY PROCESSED COPPER WIRE FOR ENAMELLING PURPOSES IS DRAWN FROM SELECTED COPPER, INSURING THE MAXIMUM CONDUCTIVITY. THIS SELECTION PLUS OUR LONG EXPERIENCE AND UNEXCELLED PLANT FACILITIES INSURE OUR CUSTOMER BETTER WIRE AT LOWER COST.

WRITE TODAY FOR SAMPLES AND PRICES —

HUDSON WIRE COMPANY
OSSINING, N. Y.

ESTAB. 1902 SUCCESSORS - ROYLE AND AKIN

WINCO AT WINSTED, CONN. PRODUCES LEAKPROOF ENAMELLED WIRE AND OTHER WINCO ENAMELLED AND COVERED WIRES.

WRITE FOR SAMPLES AND PRICES —

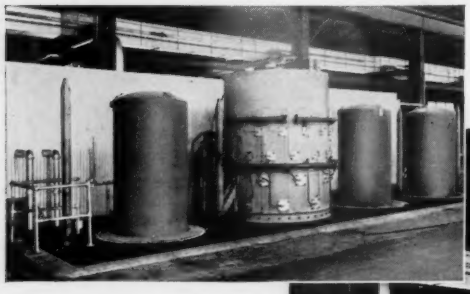
WINSTED DIVISION
HUDSON WIRE COMPANY
WINSTED CONNECTICUT

E. F. Gas Fired Bell Type Furnaces

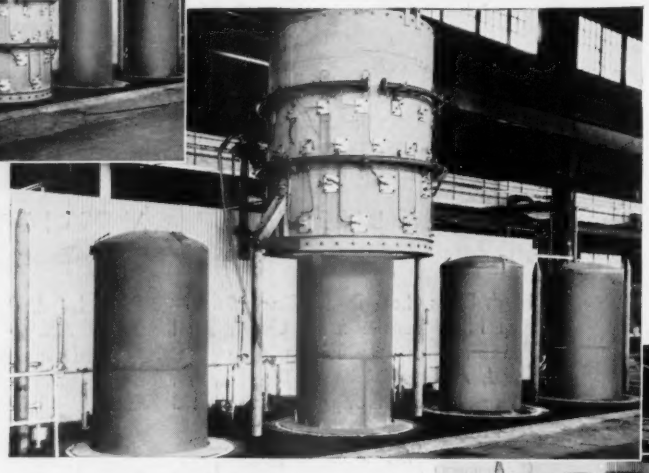
Maintain Uniform Temperature Throughout Charge

Regardless of the

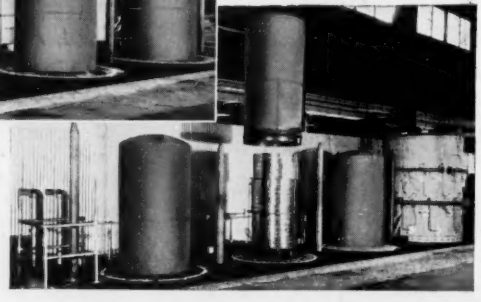
Weight, Size or Height of Load



(Above) An E. F. Bell Type Installation consisting of furnace, 4 bases, and retorts.



(Left) Each base accommodates charges up to 22,000 lbs. and coils up to 45″ in diameter.



(Right) Removing a retort from base showing bright annealed charge.

ELECTRIC FURNACES FUEL FIRED

For Annealing Strip, Wire and Other Products

Equipped with special radiant type gas burners and separate automatic temperature control zones, these E. F. gas fired removable hood type furnaces obtain and maintain uniform temperature distribution throughout the entire charge on each and every load, regardless of weight, size or height of load.

The installation shown above was designed for annealing medium and high carbon mirror-finish cold rolled steel strip, and is equipped with special E. F. gas generator equipment for producing the protective atmosphere for bright annealing without decarburization. Each base accommodates charges up to 22,000 lbs. and handles coils in any width and up to 45″ in diameter.

This installation is equipped with a pre-mix plant for mixing the gas and air in proper proportions. This eliminates all manual burner adjustments, as the gas-air mixture is previously obtained in the machine. The high turn down ratio on burners permits use of modulating type control.

This equipment is provided with 4 bases, each with motor driven centrifugal type fan for circulating atmosphere down through the center of the charge and up between the outside of coil and the gas-tight retorts.

An extremely high rate of circulation is obtained and uniform temperature is provided and maintained regardless of the size of charge. Additional information on the above or on any other type furnace will be gladly furnished on request.

The above is only one of the numerous types we build for various annealing and heat treating purposes. We build Gas Fired, Oil Fired and Electric Furnaces—Furnaces for any process, product or production. Our large and experienced engineering staff and ample manufacturing facilities enable us to make reasonably prompt deliveries. We solicit your inquiries.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production